

THE ROLE OF THE BARIUM ENEMA  
EXAMINATION IN THE DIAGNOSIS  
AND  
EVALUATION OF THE PATTERN  
AND RADIOLOGICAL FEATURES  
OF  
DISEASES OF THE LARGE BOWEL  
AT  
KENYATTA NATIONAL HOSPITAL



A dissertation submitted in  
part fulfilment for the degree of  
MASTER OF MEDICINE (RADIODIAGNOSIS)

OF

THE UNIVERSITY OF NAIROBI

BY

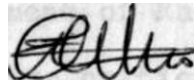
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JULY, 1985.

D E C L A R A T I O N

This dissertation is my original  
work and has not been presented  
for a degree in any other University.

Signed:\_\_\_



DR. ONDEKO, John N.

This dissertation has been submitted with  
my approval as a University Supervisor.

Signed:\_\_\_\_\_ **i w ^ r .**

DR. WACHIRA, M.

ACKNOWLEDGEMENTS.

I am very grateful to Dr. M. Wachira for being my University Supervisor, for assisting me with review of films in this study and for encouragement and criticism that helped to produce this thesis.

My special thanks go to Professor P.E. So Palmer of the University of California; currently at the University of Nairobi, Department of Radiodiagnosis, whose expert guidance^constructive criticism, references and encouragement made this study challenging and interesting.

My thanks are also due to:-

- (a) The Staff of the X-Ray Records Department, ICenyatta National Hospital, who helped in getting the X-Ray films.
- (b) The Staff of the Central Records Department, Kenyatta National Hospital, who helped in getting the case files.
- (c) Mrs. J.F. Kinuthia for the excellent secretarial work.
- (d) Last but not least, my dear friend, Musimbi Mwenesi for her continued assistance and encouragement throughout the period of this work.

STUDY OBJECTIVES.

1. To evaluate the sensitivity and specificity of a barium enema as a diagnostic procedure for the various bowel diseases seen at the Kenyatta National Hospital •
2. To evaluate the efficacy of barium enema examination at the Kenyatta National Hospital,
3. To show the radiological large bowel disease pattern at the Kenyatta National Hospital.
- 4\* To evaluate the efficiency of the barium enema examination as performed at the Kenyatta National Hospital.
5. To combine the results of the above objectives and find a possible solution to:-
  - (a) the reduction of unnecessary examination; and
  - (b) improving the diagnostic usefulness of barium enema examination.

DEFINITIONS OF TERMINOLOGIES THAT WILL FREQUENTLY BE REFERRED TO IN THIS STUDY.

1. Efficacy! A radiodiagnostic procedure is considered efficacious if it produces the desired result, alters the clinician\*s diagnostic thinking, influences the management of the patient.
  
  2. Sensitivity: The sensitivity of an examination is shown by the percentage of all patients with the disease for whom a true positive is found.
  
  - 3» Specificity: The specificity of an examination is shown by the percentage of patients without the • disease for whom a true negative is found.
  
  - 4\* False Positive: This is where an examination suggests the presence of a disease which does not truly exist.
  
  - 5» False Negative: This is where an examination fails to show a disease when it is actually present.
- Efficiency: The Benefit : Cost ratio.

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## S U M M A R Y

In this retrospective study over a period of five years, 1980 - 1984, on the value of barium enema examination at Kenyatta National Hospital, some interesting findings have been encountered.

In a total of 656 booked cases, only 382 (58.3%) attended and were examined. Of the 382 cases, 61 (15.9%) were of no diagnostic value due to poor bowel preparation, and 56 (14.6%) were untraceable leaving only 265 cases which were analysed.

Of the 265 cases, radiologists reported "normal" in 184 (69.4%) cases. However, further analysis into the files of these cases revealed 7 cases of missed colonic pathologies. Hence, the true normal cases were 177 (66.8%). In general, the specificity of barium enema examination in ruling out colonic pathology at Kenyatta National Hospital was 96.2% (177/184).

The sensitivity, efficiency and efficacy vary with the type of colonic lesion being investigated.

The commonest colonic lesion seen in this study at Kenyatta National Hospital was Aganglionosis, found in 16 (19.8%) of the 81 true positive cases.



After analysis of clinical signs and symptoms of all the 265 cases, and reasons for the barium enema examination request by the clinicians, it was found that 145 (54\*7%) cases did not need this investigation for a diagnosis to be made. In terms of cost, a saving of Kshs.43,500/- could have been made.

## i n t r o d u c t i o n ' "

In 1895, X-Rays were discovered by Professor Roentgen in what appeared to be a very simple experiment his photographic papers which were in a completely light proof container had been darkened, by what he was unable to explain. Later, he proved that the high tension discharge tubes he was working with in his laboratory were responsible for producing the rays which darkened his photographic papers. He named the rays "X" as he did not know their nature then.

Roentgen himself and others in the medical field found a great potential in the use of these "X<sup>H</sup>" rays because they could go through the body and produce pictures which could be used to diagnose disease or injury. It was not until nine years later, in 1904, that Schiile for the first time attempted an X-ray study of the colon using a bismuth compound enema<sup>v</sup> ' . In 1911 Haenisch made a fluoroscopic study of the colon using bismuth subcarbonate enema. Colonic examinations done at what time were of low diagnostic value. Improvements with modifications have made colonic enema examination one of the very useful and reliable radiodiagnostic procedures.

In the modern era, barium sulphate is the radiopaque

material usually used in enema examinations of the colon. However, the accuracy of the outcome of each examination depends very much on bowel preparation prior to the examination (6).

As with all diagnostic procedures, a limit to their usage, through a careful selection of patients, is of paramount importance. This is more so for barium enema examinations, which involve radiation exposure to the patient with relatively high doses. A single complete barium enema examination usually gives a total body radiation of 3.96 milligray while, for comparison, chest radiographs postero-anterior and lateral deliver about 0.058 milligray (12). X-rays are strongly ionising and, as such, exposed cells are prone to genetic mutation with possible sterility in the case of gonads; and neoplastic change in others. Moreover, barium enema examinations are costly, on average a single examination costs about Kshs.300/- at the Kenyatta National Hospital.

According to the World Health Organisation scientific group on "The indication and limitation of major X-ray diagnostic investigations" (Geneva 1983), radiology accounts for 6 - 10 per cent of health care expenditure. On a global scale, its use in radiodiagnosis is the largest man-made source of

population exposure to radiation, It contributes 20% of natural background radiation and in fact this approaches 50% in the developed countries<sup>(37)</sup> .

Going through the literature, one finds that very little has been done in the way of efficacy and evaluation studies of radiodiagnostic examinations, barium enema included. Yet at the same time we are aware vaguely, that most of the X-ray requests made by physicians are unnecessary, which, if not requested, would reduce radiation dose and save a lot of very badly needed funds, especially in the developing countries®

#### PRESENT STUDY.

This retrospective study covering a period of five years (1980 — 1984)» has analysed barium enema examinations requested by clinicians from various clinics and wards at Kenyatta National Hospital. The objectives, as already outlined on a previous page (v), are to find out how effective barium enema examination is at the Kenyatta National Hospital and what modifications can be made to increase accuracy and cut down on unproductive examinations in this hospital.

## MATERIALS AND METHOD

From the records section of the X-ray department, Kenyatta National Hospital, a list of all the patients booked for barium enema examination during the period 1980 - 1984 was compiled. Corresponding X-ray films were then extracted from the filing cabinets.

It became apparent from this procedure, that a number of patients had failed to turn up for their appointments, and a number of films, though recorded, were missing. There thus remained only a percentage of films from the total booking list to be examined and analysed.

Among the available X-ray films, the normals were separated from those with evident pathology. The pathology did not necessarily have to be the one queried by the clinician. Discussion was carried out with a senior radiologist for confirmation of pathology.

Further information on all cases for which films were available was obtained from the files in the hospital's central records department. Files of the radiologically normal patients had to be checked in order to determine why a request for barium enema was made.

In the central records department approximately 25% of the files for the radiologically normal patients were not available. However, for those which showed pathology only a few were missing, but their histology reports were in the pathology department.

For the convenience of this study, files and films with pathologic indication were categorised into groups of

- (a) Congenital lesions;
- (b) Mass lesions;
- (c) Inflammatory lesions and
- (d) Others.

In each group, signs and symptoms with which the patient presented were recorded. Also recorded was the diagnosis reached by the clinician prior to ordering a barium enema examination. Age was recorded only in categories where it had clinical and diagnostic significance. All this information is necessary in correlating the clinician's diagnosis, radiological diagnosis and histologic diagnosis.

A record was made of cases which had other examinations such as sigmoidoscopy and rectal examinations prior to a barium enema examination being

ordered by the clinician\* There were also cases which had had other abdominal radiological examinations: a record of which was also made as will be seen in the results.

## M E T H O D

The first barium enema (as mentioned earlier), was done in 1904 by Schiile. Since then, modifications, with the aim of perfecting the procedure, have been in progress. Currently, barium enema examination is a very useful diagnostic tool in skilled hands<sup>v</sup> '.

Bowel preparation must be done well and properly for reliable films of diagnostic value to be expected. In most centres it consists of the patient going on light diet for three days preceeding the day of appointment. On each of the two nights prior to the examination, an aperient is taken. Many centres, especially in Europe and America, use castor oil which gives very good results. At Kenyatta National Hospital, dulcolax tablets are given; 3 on each of the two preceeding nights. The morning of the examination, a cleansing enema is given in most European and American centres. Usually this consists of a warm saline enema or soap or just plain warm water to clean the bowel just before barium enema examination is started. This has been found to give very good results as it is complementary to the aperients. In Kenyatta National Hospital cleansing enemas are not given.

The patient who has been satisfactorily prepared



lies in the left lateral position on the screening table. The nurse or an assistant, wearing sterile rubber gloves, inserts the enema tip into the rectum. The radiologist then allows the flow of barium sulphate from a can raised to about 3 feet to 4 feet above the table while he monitors its progress into the colon on a television screen.

A lateral and anterior posterior of the rectum are then taken, followed by a left anterior oblique of the left colon, then transverse colon, then a right anterior oblique of the hepatic flexure and the right colon view is taken. With a good screen, areas of abnormality are visible and more pictures are taken as necessary. After this, a full length AP view of the barium filled bowel is taken in the supine position.

The patient is then asked to go to the toilet to evacuate as much of the barium sulphate as possible. A post-evacuation film is then taken. After this stage, most centres have made it a routine to inflate the colon with air or carbon dioxide to provide a double contrast. Double contrast examinations have been proven to greatly increase diagnostic accuracy, especially for tiny colonic lesions like polyposis coli^^. At Kenyatta National Hospital, double contrast studies are not routinely done.

R E S U L T S

In total, 656 barium enema bookings were made during the 5 year period of 1980 - 1984 at the Kenyatta National Hospital. Of these, 382 (58.35%) attended and were examined. It is clear from this figure that a failure rate of 41.7% was observed. The explanation for this is attributable to the fact that Kenyatta National Hospital X-ray department has relatively few screening machines; occasionally two, but most of the time only one when the other is broken down. As a result, the work load is high, and many patients get distant bookings ranging from one to three months. By the time these bookings are due, some patients have sought help in other centres, especially private hospitals; or their conditions have improved and they see no need to attend; or they may have died at home. The frequent breakdown of machines and lack of chemicals in the department also contributes to this failure of attendance. Patients may attend on their duly booked dates, but not be examined due to the given reasons.

Out of the 382 examinations performed, 61 (15.9%) were of no diagnostic value because of poor bowel preparation and arrangement for repeat examination had to be made. The booking register indicated that 8 (13.1%) patients turned up for repeat examination. However, there

was no trace of the repeat films. The low attendance rate for repeat examinations can be attributed to the \* same reasons as failure of attendance for the first booking, viz: distant bookings, machine breakdown, repeat done at another centre, improvement, or death.

It was not possible to trace 56 (14»6<sup>^</sup>) of the cases which were done. These were regarded as lost or misplaced. Therefore, the total number of cases done but not available for this study was (61 + 56) 1175 which leaves a figure of (382 - 117) 265 cases which form the backbone of this study.

Table I displays the radiological diagnosis of the 265 cases analysed with their frequency distribution in numbers and percentage.

TABLE I.

Radiological Diagnosis and Frequency Distribution of the

- 265 Cases Analysed.

RADIOLOGICAL DIAGNOSIS	PATIENTS	%
Normal.	184	69.4
Aganglionosis (Hirschsprung <sup>1</sup> s Disease).	17	6.4
Carcinoma.	12	4.5
Diverticulosis.	9	3.4
Prediverticular Disease.	9	3.4
Polyyps,	6	2.3
Irritable Bowel Syndrome.	7	2.7
Cathartic Colon.	4	1.5
Amoeboma.	4	1.5
Fistula (RVF).	3	1.1
Schistosomal Granuloma.	3	1.1
Intussusception.	3	1.1
Idiopathic Megacolon.	2	0.8
Ulcerative Colitis.	2	0.8
Amoebic Colitis.	0	0
	265	100.0

The diagnoses presented on Table I were made entirely from barium enema examination. The Table indicates that 69.4% of the cases were found to be normal. The commonest pathology diagnosed radiologically

was aganglionosis, 6.4% followed by carcinoma 4.5% and so on. After analysis of all the 265 case files, some revelations were seen as shown on Table II.

TABLE II.

Final Diagnosis and Frequency Distribution of the 265 Cases Analysed.

FINAL DIAGNOSIS	PATIENTS	%
Normal.	177	66.8
Aganglionosis (Hirschsprung's Disease).	16	6.0
Carcinoma.	16	6.0
Diverticulosis.	10	3.9
Polyps.	9	3.4
Prediverticular Disease.	8	3.0
Irritable Bowel Syndrome.	5	1.9
Amoeboma.	5	1.9
Schistosomal Granuloma.	4	1.5
Cathartic Colon.	3	1.1
Fistula (RVF).	3	1.1
Idiopathic Megacolon.	3	1.1
Intussusception.	3	1.1
Ulcerative Colitis.	2	0.8
Amoebic Colitis.	1	0.4
	265	100.0

Table II shows figures which were obtained after analysis of the files. The diagnoses presented were confirmed by various methods such as histology on biopsy, sigmoidoscopy and laboratory tests. It is evident that some cases were misdiagnosed on barium enema examination, for example, 7 cases of pathology were missed in the 184 radiologically normal cases.

Table I and II are a summary of what this study at the Kenyatta National Hospital has found. The details of these findings are in the text. We shall start with Category A : Congenital Lesions.

CATEGORY A : CONGENITAL LESIONS.

Aganglionosis and idiopathic megacolon were the congenital lesions seen in this study. There were 16 and 3 histologically confirmed cases of aganglionosis and idiopathic megacolon respectively. The clinicians<sup>1</sup> impression was aganglionosis in all 19 cases. Analysis results were as follows:

- Barium enema diagnosis : 17 aganglionosis.

2 idiopathic megacolon.

- Confirmatory histologic diagnosis s 16 aganglionosis.
  - 3 idiopathic megacolon.

Diagnostic Evaluation.

Afranplionosis.

Clinician's diagnosis : 16/16 correct =  
100% sensitivity but with  
3 false positives.

Barium enema diagnosis : 16/16 correct =  
100% sensitivity but with  
1 false positive.

Idiopathic Megacolon.

Clinician's diagnosis : 0 correct  
3 false negatives.

Barium enema diagnosis : 2/3 correct =  
66.7% sensitivity but with  
1 false negative.

The sensitivity rates are relatively high in both diseases, but there is a 6.2% chance of confusing aganglionosis with idiopathic megacolon on barium enema examination. Clinical presentation of these two

conditions are very similar. The table below shows the sign and symptom frequency recorded from the 19 case files.

TABLE III

SIGN AND SYMPTOM	FREQUENCY	%
Abdominal distention.	19	100.0
Constipation.	19	100.0
Weight loss.	13	68.4
Vomiting.	7	36.8
Pyrexia.	4	21.0

Evident from the above Table, the three cardinal symptoms in the 19 cases are:— abdominal distention, constipation and weight loss though the latter was less frequent. There was no difference between aganglioncsis and idiopathic megacolon cases in the sign and symptom pattern.

Age distribution for the 16 cases of aganglioncsis is shown in the Table and Histogram below.



TABLE IV.

Age Distribution in A<sup>an</sup>lionosis.

AGE.	MONTHS	MONTHS	MONTHS	MONTHS
	0 - 10	11 - 20	21 - 30	31 - 40
NUMBER OF CASES.	10	3	2	1

FIGURE 1.

Histogram of Age Distribution in A<sup>an</sup>lionosis.

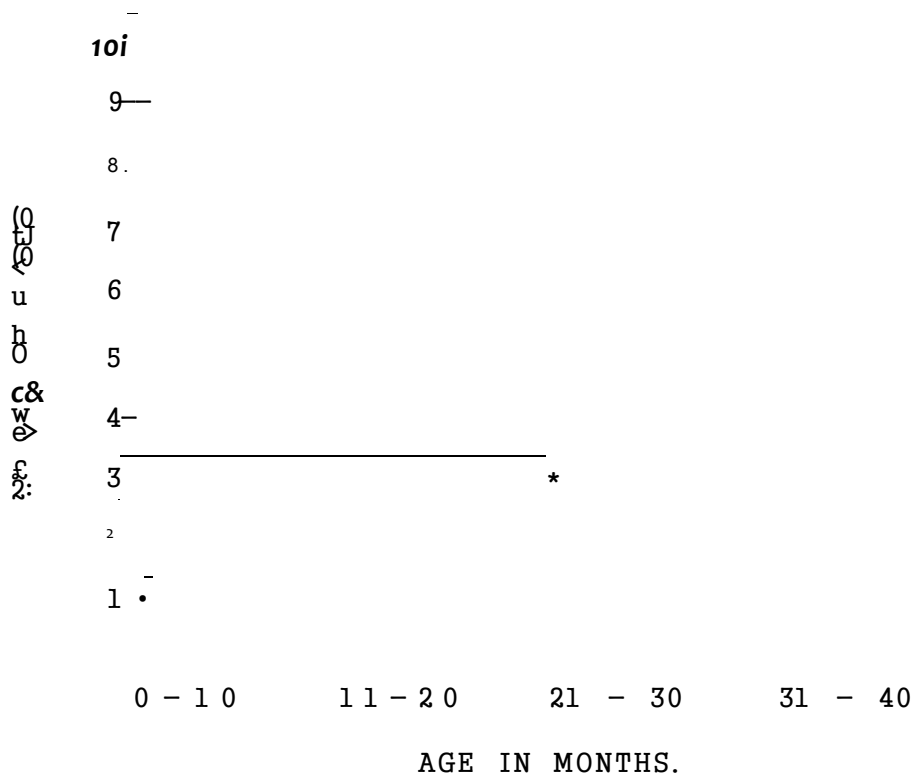


Table IV and Figure 1 indicate that the age group post frequently affected with aganglionosis at the Kenyatta National Hospital is under 10 months.

Sex distribution was 11 males to 5 females giving a ratio of 2 : 1 at this hospital\*

The 3 cases of idiopathic megacolon were aged 24, 30 and 36 months. This age is older than that of aganglionosis; and the male to female ratio was 2 : 1 . However, the limited number of cases with idiopathic megacolon may not be satisfactory to use these statistics as a point of differentiation from aganglionosis.

Barium enema is a highly sensitive and specific procedure in the diagnosis of aganglionosis and idiopathic megacolon.

CATEGORY B : THE MASS LESIONS.

Under this category the following conditions were seen and confirmed.

- |                        |           |
|------------------------|-----------|
| 1. Malignant Neoplasm. | 16 cases. |
| 2. Polyyps.            | 9 cases.  |

3. Amoeboma, 5 cases.
4. Schistosomal Granuloma. 4 cases.

B - 1 Malignant Neoplasm.

There were 16 cases of histologically confirmed carcinoma, 12 were adenocarcinoma, 2 anaplastic carcinoma, 1 ovarian carcinoma infiltrating and blocking the rectum and 1 small nodular carcinoma which was revealed on analysis of the 184 radiologically "normal" cases.

Diagnostic Evaluation.

Clinician's diagnosis : Of the 265 cases, the clinician made a "confident" diagnosis in 30 cases and asked for a ruling out of colonic carcinoma in 31 cases.

Sensitivity : Out of the 30 cases, only 15 were correct, giving 50% sensitivity and (15 + 31) 46 misdiagnoses.

Note: The 16th confirmed case was a nodular carcinoma which had an enema examination for abdominal pain ?cause and not for carcinoma.

Barium enema diagnosis : 12/16 correct =  
75% sensitivity but  
1 false negative.

Note: The 12 cases were diagnosed with a 2nd differential such as amoeboma and schistosomal granuloma.

Below is a Table of the sign and symptom frequency recorded from the 16 case files.

TABLE V.

Clinical Sign/Symptom Frequency in the 16 Carcinoma Cases.

SIGN AND SYMPTOM	FREQUENCY	%
Change of bowel habits.	13	81,5
Blood per rectum.	11	68,7
Weight loss.	10	62,5
Weakness.	10	62,5
Abdominal mass.	9	56,3
Anorexia.	8	50,0
Diarrhoea.	7	43,8
Constipation.	6	37,5
Anaemia.	6	37,5
Abdominal pain.	2	12,5

It can be deduced from Table V that the four most frequent and important clinical signs or symptoms in carcinoma of the colon are:- change of bowel habits, blood per rectum, weight loss, and weakness in descending frequency.

Age distribution was also analysed and the Table below gives the results.

TABLE VI.

Age Group Distribution in Carcinoma.

AGE IN YEARS.	20 - 30	31 - 40	41 - 50	51 - 60+
NUMBER OF CASES.	1	2	5	8

FIGURE 2.

Histogram of Age Distribution in Carcinoma.



Table VI and Figure 2 indicate that colonic neoplasm, in this study, occurs more commonly in the older age group - above 40 years.

Coupling the clinical symptoms and the age group, the clinician can effectively reduce unnecessary requests of barium enema examination to rule out malignant neoplasm.

Colonic neoplasm has a pattern of distribution. Examining this fact in this study, the Table below reveals the results as found from the X-ray films and case files.

TABLE VII.

Colonic Neoplasm Distribution Pattern.

SITE	CAECUM	ASCENDING COLON	DESCENDING COLON	SIGMOID COLON	RECTUM
NUMBER	1	2	2	5	6

The above Table shows that 13 of the 16 (81.3%) cases of malignant neoplasm were found in the descending colon and the rectosigmoid colon in this study. With regard to the objectives and the aims of this thesis, this is a very significant finding. The region most commonly

affected is within easy reach of a sigmoidoscope and biopsy thereby reducing the number of barium enema examinations.

It was observed in most of the case files that requests for barium enema examination were made prior to sigmoidoscopy. However, nearly all the patients had a record of per rectum examination before requesting for barium enema examination, especially in cases from the out-patient clinics.

#### D - 2 Polyps.

The total number of polyps seen in this study at Kenyatta National Hospital was 9. Six (6) cases were radiologically diagnosed and subsequently confirmed histologically. Of the six, 2 were cases of polyposis coli while 4 were the solitary pedunculated type. 3 cases were revealed on further analysis of the 184 supposedly normal cases.

Of the 9 cases, clinicians had requested barium enema examination for diagnosis of polyps in only 4 cases. The others were incidental findings during enema examination for other purposes.

Diagnostic evaluation\*

Clinicians<sup>1</sup> diagnosis : 4/9 correct =  
44,4% sensitivity but  
5 false negatives.

Barium enema diagnosis : 6/9 correct =  
66,7% sensitivity and  
3 false negatives.

TABLE VIII.

Clinical Sign and Symptom Distribution in the 9 Cases of  
Polyps.

SIGN AND SYMPTOM	FREQUENCY	%
Blood per rectum ?Polyps.	5	55.6
Abdominal pain ?Diverticulosis TPolyps.	4	44.4
Family history of polyps TPolyps.	4	44.4
Constipation ?Cause.	3	33.3
?Amoebic colitis.	2	22.2

It is evident from the above Table that polyposis does not seem to have a definite sign and symptom pattern which would help the clinician in making an accurate



diagnosis\*

Comment.

Barium enema examination made a definite diagnosis in 66.7% of the cases missing the 3 among the 184 "normal" cases. These 3 were discovered as the patients continued to attend the out-patient clinic because of continued pain necessitating the clinician to request for sigmoidoscopy. Sigmoidoscopy reported small pedunculated polyps in the rectosigmoid junction in 2 cases and 1 case of polyp in the rectum. Further investigation into these 3 cases revealed that the clinicians were not of the opinion that polyps were the cause of the patients<sup>1</sup> problem.

Rechecking the X-ray films of the 3 cases did not show polyps. However, there was bowel overlap in the pelvic colon of all three cases. No double contrast examination was done. This could explain why the lesions were missed. Sigmoidoscopy was done about 6 weeks after the barium enema examination. Could a diverticulum have developed in this time? Rather unlikely.

B - 3 Amoeboma.

There were 5 cases of histologically proven amoeboma.

From the files it was found that the clinicians had made correct diagnosis in 3 cases. Barium enema examination diagnosed 4 cases with "confidence" and suggested further investigation to rule out carcinoma of the colon or schistosomal granuloma in 1 (one) case. Thus the radiological diagnosis would be regarded as 4 cases.

Diagnostic evaluation.

Clinicians' diagnosis : 3/5 correct =

60% sensitivity.

Barium enema diagnosis : 4/5 correct =

80% sensitivity with

1 false negative.

TABLE IX.

Sign and Symptom Frequency in the 5 Cases of Amoeboma.

SIGN AND SYMPTOM	FREQUENCY	%
Past history of E.Histolytica cyst in stool.	4	80
Abdominal mass.	3	60
Change of bowel habits.	3	60
Abdominal pain.	2	40
Constipation,	2	40
Nausea,	1	20

From the above Table it is clear that past history of

E. histolytica cysts in stool, abdominal mass and a change in bowel habits are the 3 important signs and symptoms in amoeboma.

Comment»

\*

It is apparent from these findings that it is not easy to confidently diagnose amoeboma from the barium enema examination as it resembles other mass effects in the colon, such as, carcinoma and schistosomal granuloma. Even the sign and symptom presentation tends to overlap with that found in carcinoma. However, past history of E. histolytica in the stool is a fairly reliable guide to diagnosis.

Coupling the clinical history with the physical findings (both of which are rarely detailed on X-ray request forms at the Kenyatta National Hospital), the radiologist would be in a much better position to make up his mind between amoeboma and other differentials.

Analysis of the 184 normal cases did not reveal any case of missed amoeboma.

B — 4 | Schistosomal Granuloma.

In total, the clinician had diagnosed or made an

impression of schistosomal granuloma in 10 of the 265 cases in this study. However, they made ?carcinoma as a 2nd differential in 3 of the cases.

Barium enema examination diagnosed 3 cases as schistosomal granuloma, but also suggested further investigation such as sigmoidoscopy to rule out malignancy.

A further check into the 184 supposedly normal case files found that there was one case of schistosomal granuloma which had been missed on barium enema examination. A double check of these particular X-ray films showed an area of minimal haziness which could easily have escaped notice. "When a biopsy was taken from the area, eggs of schistosoma mansoni were seen.

Histology confirmed a total of 4 schistosomal granuloma cases through sigmoidoscopic biopsy.

Diagnostic evaluation.

Clinicians\* diagnosis : 4/4 correct but

6 false positives.

Barium enema diagnosis : 3/4 correct =

75/5 sensitivity but  
1 false negative.

From the clinical signs and symptoms, the following were noted in the 4 proven cases. (See Table X),

TABLE X.

Sifrn and Symptom Frequency in the 4. Cases of Schistosomal Graimloma .

SIGN AND SYMPTOM	FREQUENCY	
Past history of S» Mansonii eggs.	4	too
Abdominal pain.	3	75
Blood in stool.	3	15
Constipation,	3	75
Weight loss.	2	50
Anorexia,	1	25

Comment.

The six (6) false positives diagnosed by the clinicians all had a past history of schistosoma mansoni eggs in the stool and various other vague abdominal complaints like pain and diarrhoea. The clinicians seen to have overdiagnosed on the grounds of past history of schistosoma mansoni eggs together with the other symptoms.

Barium enema sensitivity in diagnosing schistosomal granuloma is good. It would be even better if full clinical information was made available to the radiologist on the X-ray request form. Unfortunately this is rarely the case at Kenyatta National Hospital.

From the clinical signs and symptoms it seems that the 3 most important that would lead to a correct diagnosis of schistosomal granuloma are:- past history of schistosoma mansoni eggs in the stool, blood in the stool and constipation.

CATEGORY C : INFLAMMATORY/ULCERATING COLONIC LESIONS.

There was a total of 30 confirmed cases in this category. The lesions were divided into six groups as shown in the Table below.

TABLE XI.

Frequency of Inflammatory/Ulcerating Lesions.

DISEASE	FREQUENCY	%
Diverticular disease.	10	33.3
Pre-diverticular disease.	8	26.7
Irritable bowel syndrome.	5	16.7
Cathartic colon.	4	13.3
Ulcerative colitis.	2	6.7
Amoebic colitis.	1	3.3
	30,	100.0

In this category it was debatable as to whether pre-diverticular disease should be grouped with diverticular disease as one and the same disorder, or if they should be viewed as separate entities. By definition, a diverticulum is an outpouching or a sac from a hollow organ (Blakiston's Medical Dictionary). The term "pre" denotes an early evidence of what may become a diverticulum and is usually observed on X-ray films. So to group them together may give a false high incidence of diverticulosis. They have therefore been discussed separately in this study and, in fact, they occur in different age groups.

#### C - 1 Diverticular Disease.

From the 265 cases, clinicians requested barium enema examinations for 8 cases, which had mainly abdominal pain, for the purpose of ruling out diverticular disease.

A total of 10 cases were confirmed to have diverticular disease. Barium enema diagnosed 9 cases, only 5 of which came from - ?diverticula on the clinicians request form. This means that the other 4 cases diagnosed on barium enema examination were incidental findings during examination for other purposes.

The tenth case was discovered by sigmoidoscopy

months after the barium enema examination as the patient continued to attend the out-patient clinic with persistent complaint of pain. There were two small diverticula in the rectosigmoid region.

Diagnostic evaluation.

Clinicians\* diagnosis : 5/10 correct but

3 false positives.

Note: Although the clinicians suspected 8 cases, only 5 of the confirmed cases came from the 8. The other 5 cases were incidental findings.

Barium enema diagnosis : 9/10 correct =

90% sensitivity but

1 false negative.

TABLE XII.

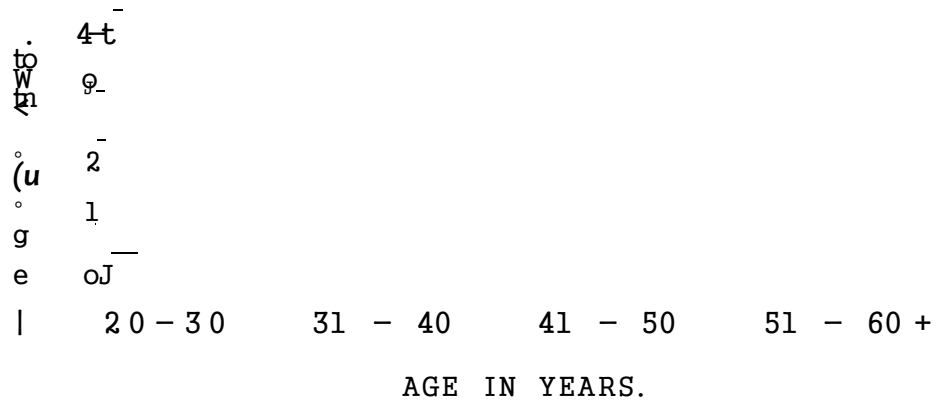
Sign and Synpton Distribution in the 10 Cases of Diverticular Disease.

SIGN AND SYMPTOM	FREQUENCY	%
Constipation.	6	60
Left lower abdominal pain.	6	60
Change of bowel habits.	4	40
Blood per rectum.	4	40
Dyspepsia.	2	20
Nausea.	1	10
Weight loss.	1	10



FIGURE 3\*

Histogram of the Age Group Distribution in the 10 Cases of Diverticulosis.



Sex incidence : There were 5 males and 5 females giving a ratio of 1 : 1.

Comment.

From the clinical signs and symptoms in the confirmed cases, it appears that constipation and left lower abdominal pain together with blood per rectum form a combination that could lead to a diagnosis of diverticulosis. However, these symptoms are also common in carcinoma and other large bowel pathologies. It is no surprise therefore, that clinicians had given other diagnoses in those cases of diverticulosis found incidentally.

Barium enema examination had a high sensitivity rate

of 90% with only one false negative. A possible reason for this false negative could be that at Kenyatta National Hospital double contrast examination is not done. The diverticula were in a heavily overlapped bowel loop\*

C - 2 Pre-Diverticular Disease.

None of the 8 cases seen under this group were sent to the X-ray department to be investigated for pre-diverticular disease. The following impressions were those given by the clinicians.

?Diverticular disease	1 case.
Constipation ?cause	5 cases.
T?Carcinoma of colon	2 cases

Table XIII shows the clinical signs and symptoms recorded in the 8 cases.

TADIE XIII.

Sipjn anci Symptom Distribution in the 8 Cases of

< Pre-Divcrticular Disease.

SIGN AND SYMPTOM	FREQUENCY	%
Constipation ?cause.	5	62.5
Diarrhoea on and off,	4	50.0
Colicky abdominal pain.	4	50.0
Abdominal pain.	3	37.5
Palpable abdominal mass.	2	25.0
Abdominal distention on and off.	1	12.5

The age distribution ranged from 21 - 38 years.

There was no evidence of sex bias,

DiafTnostic evaluation.

Clinicians did not make any diagnosis of pre-diverticular disease,

barium enema diagnosis i 8/8 correct =

100% sensitivity but

1 false positive.

Comment.

After a barium examination had excluded a mass effect in the two cases with palpable masses, a diagnostic laparotomy demonstrated ovarian tumours in both. However, the two cases had pre-diverticular disease as well.

The false positive in barium enema examination was attributed to observer error after a further scrutiny of the films.

C - 3 Irritable! Dowel Syndrome.

Under this group, clinicians made an impression of irritable bowel syndrome in 14 cases. Barium enema examination showed 7 cases to have features of irritable bowel syndrome, but also suggested the possibility of pre-diverticular disease in 2 of the 7 cases.

The 7 cases continued to attend the out-patient clinic and 2 were found to be psychosomatic cases. The patients admitted to have been taking psychiatric drugs. In the final analysis it was thus felt that the true cases of irritable bowel syndrome were 5»

The case files of the 5 patients did not show any

further investigations done. The patients were simply given the appropriate medication and there was indication that they improved on sedatives. The recurrence of symptoms, however was high.

There was an age range from 25 - 35 years and no significant sex bias.

TABLE XIV.

Sign and Symptom Distribution in the 15 Cases of Irritable Bowel Syndrome.

SIGN AND SYMPTOM	FREQUENCY	$f_p$
Abdominal pain.	4	80
Constipation .	4	80
Diarrhoea alternating with constipation.	4	80
Anxiety and nervousness.	4	80
Diarrhoea,	3	60
Nausea.	2	40
Mucoid stool.	2	40

From Table XIV it would seem that the cardinal sign and symptom combination in irritable bowel syndrome is : abdominal pain, constipation alternating with diarrhoea, constipation, anxiety and nervousness. However, these

signs and symptoms are common in other colonic pathologies. This makes it difficult to clinically diagnose irritable bowel syndrome - it may only be suspected.

Diagnostic evaluation.

Clinicians\* diagnosis : 5/5 correct but with  
9 false positives.

Barium enema diagnosis : 5/5 correct =  
100% sensitivity but with  
2 false positives.

Comment.

Barium enema has a high sensitivity in diagnosing irritable bowel syndrome, but can give a false positive in 40% of the cases.

C - 4 . Cathartic Colon.

There was a total of 3 confirmed cases of cathartic colon. Barium enema gave a diagnosis in 4 cases. Clinicians did not diagnose or suspect any of the 265 cases as cathartic colon.

Diagnostic evaluation.

Clinicians did not give any correct diagnosis.

Barium enema diagnosis : 3/3 cases correct but  
1 false positive.

Comment.

The 3 cases confirmed as cathartic colon had sigmoidoscopy with biopsy to rule out ulcerative colitis. The case files revealed that the patients had been chronic users of laxatives because of constipation. The final analysis concluded that they were cases of cathartic colon. One false positive was attributed to observer error.

C - 5 Ulcerative Colitis.

Only 2 cases were confirmed as ulcerative colitis. The clinicians had sent 10 cases for barium enema examination to rule out this condition (6 with a diagnosis of ulcerative colitis and 4 with ?ulcerative colitis),

Barium enema examination made a definite diagnosis of ulcerative colitis in 2 cases and felt that 4 were cathartic colon and 4 were normal from the 10 cases referred by the clinicians.

Diagnostic evaluation.

Clinicians\* diagnosis : 2/2 correct but with  
4 false positives.

Barium enema diagnosis : 2/2 correct =  
100% sensitivity.

Comment»

In this study at Kenyatta National Hospital, barium enema examination was found to have 100% sensitivity in the diagnosis of ulcerative colitis.

C - 6 Amoebic Colitis\*

One (1) case of amoebic colitis was found among the 184 cases passed as normal by the radiologists. This finding had been made by sigmoidoscopy. The lack of sensitivity in barium enema examination was likely due to poor bowel preparation or observer error. The case was found among those with amoebic colitis from the clinicians.



CATEGORY D : OTHERS.

Under this category were found the following

- (1) Fistula (RVF).                      3 cases.
- (2) Intussusception.                    3 cases.

D - 1 Fistula.

There were 3 cases of confirmed rectovaginal fistula (RVF). The clinicians had diagnosed 3 cases and barium enema had confirmed all three.

Diagnostic evaluation.

Clinicians<sup>1</sup> diagnosis : 3/3 correct.

Barium enema diagnosis : 3/3 correct =  
100% sensitivity.

Comment.

The main reason why a request was made for barium enema examination in the 3 cases of rectovaginal fistula was not for a diagnosis, but to visualise the site of the fistula and possibly determine the size. The question must be asked, - "Is this proper use of barium enema

examination?" - If a patient passes faeces per vagina, the presence of a fistula is obvious. Even if it was claimed that the barium enema is to aid the surgeons, the argument would be erroneous. The repair procedure of a rectovaginal fistula is not guided by X-ray findings as it is in the case of removing a bullet from the skull, for example. Perhaps these three barium enema examinations were unnecessary.

D - 2 < Intussusception.

There were 3 cases of intussusception in this study. The clinicians had made a diagnosis of intussusception in 2 cases and faecal impaction in 1 case. Barium enema diagnosed 3 cases of intussusception. It may be interesting to note here that the procedure of the barium enema examination actually reduced all three cases of intussusception.

The three cases were 1 boy aged 8 months and 2 girls of ages 2 years and 3 years.

Diagnpstlc evalustion.

Clinicians\* diagnosis : 2/3 correct with  
1 false negative.

Barium enema diagnosis : 3/3 correct =  
100/o sensitivity.

ANALYSIS OF THE 184 CASES PASSED AS NORMAL DY BARIUM  
ENEMA EXAMINATION.

Specificity of a diagnostic procedure is the percentage of patients without a disease for whom a true negative is found.

During the result analysis of the true confirmed pathologic cases, it was noticed that some of them were from the 184 cases passed by enema examination as normal. These pathologic cases were found incidentally during an analysis of the 184 cases to determine why a barium enema examination request was made for them. Below is a Table of the 184 cases divided into groupings according to the clinical diagnosis or main symptom which prompted barium enema examination.

TABLE XV.

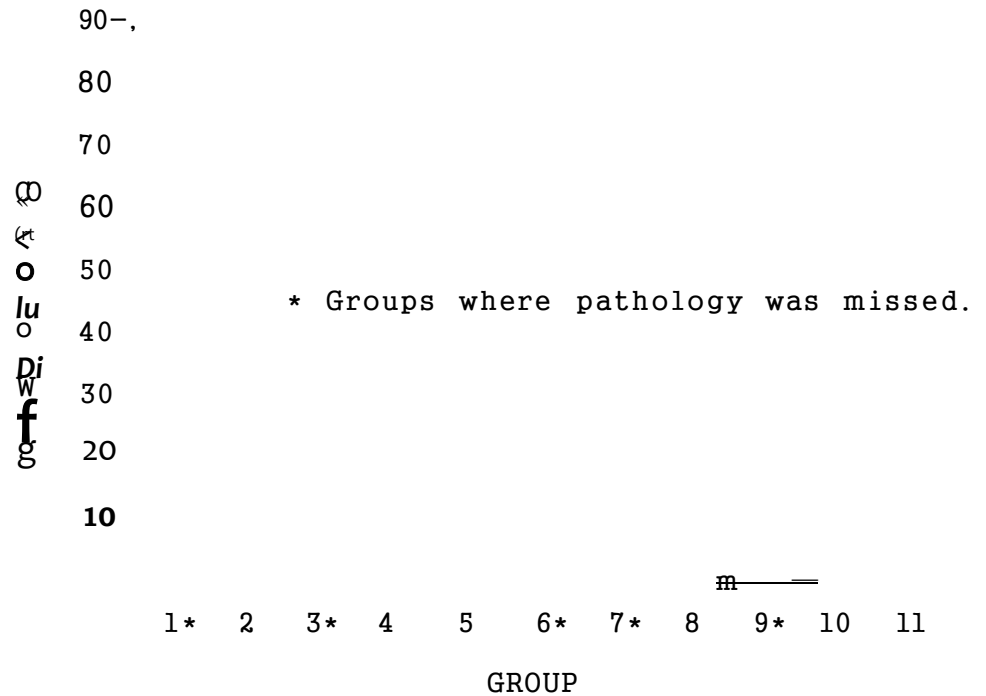
Frequency of Clinical Diagnosis/Sign and Symptom/  
Impression in the 184 Radiologically Normal Cases.

GROUP	CLINICAL DIAGNOSIS/IMPRESSION/ SIGN AND SYMPTOM	FREQUENCY	%
1*	Lower abdominal pain ?cause.	84	45.7
2	Chronic constipation ?cause.	31	16.8
3*	Abdominal mass ?Ca colon.	20	10.9
4	Abdominal pain with ?epigastric mass.	16	8.7
5	?Irritable bowel syndrome.	8	4.2
6*	?Schistosomal granuloma (fibrosis).	7	3.8
7*	Diarrhoea with weight loss ?cause.	6	3.3-
8	?Ulcerative colitis.	4	2.2
9*	?Amoebic colitis.	4	2.2
10	Hirschsprung's Disease.	2	1.1
11	?Polyps.	2	1.1

\* Groups in which colonic pathology was missed on  
barium enema examination.

FIGURE 4.

Frequency Histogram of Table XV.



We find from Table XV and the Histogram in Figure 4 that the highest clinical impression/sign and symptom were!- (1) lower abdominal pain followed by (2) chronic constipation ?cause.

The case files of each group were checked to ascertain if they were really all true negatives.

(Group) 1 t Lower Abdominal Pain TCausc.

Two (2) cases were missed on barium enema examination

in this group. One case of an old man with a solitary polyp in the rectosigmoid region and one with two diverticulac in the sigmoid region. Possible reasons for the error have been given in categories B — 2 and C - 1 respectively. The remaining 82 cases did not indicate any pathology that was missed.

Specificity :  $82/84 = 97*6\%$ .

(Group) 2 .: Chronic Constipation ?Cause.

The 31 case files in this group did not reveal any colonic pathology missed by barium enema examination. Apparently most of them were examined for exclusion of colonic pathology.

Specificity :  $31/31 = 100\%$ .

(Group) 3 .: Abdominal Mass ?Ca Colon.

Two cases were missed on barium enema examination in this group. One case of nodular carcinoma in the rectosigmoid region and one case of a small sesilc polyp in the same region. Possible reasons for the error are explained in categories B - 1 and B - 2 respectively. The rest of the case files did not show anything significant except for two female cases which had ovarian masses and one man with

mesenteric lymphadenopathy. These were diagnosed on subsequent diagnostic laparotomy.

Specificity : 18/20 = 90%

(Group) 4. \*, Abdominal Pain with ?Epigastric Mass.

There was no pathologic case missed in this group. However, the case files showed the following:-

Two cases had previously had E. histolytica in their stool and effective treatment given.

Nine of these cases had a barium meal examination prior to barium enema examination. The meal reports were normal.

One case later presented with complaints of change in bowel habits, weight loss and melena stool. A barium enema examination was normal. A further clinical check on the patient revealed a barely palpable epigastric mass. A barium meal done showed carcinoma of the stomach and was confirmed on post-mortem.

The rest of the cases had nothing significant. In total there were 16 cases.

Specificity : 16/16 = 100%

. /Group) 5. Writable Bowel Syndrome.

The 8 case files in this group did not show any colonic lesion missed by barium enema examination. It was noted however, that most of these cases had vague abdominal pain and had an irritable and nervous personality in general.

Specificity : 8/8 = 100%

(Group) 6 : ^Schistosomal Fibrosis (Granuloma)..

Of the 7 cases in this group, 1 (one) case was missed by barium enema as a true positive. The reason for this is under category B - 4.

All the seven case files showed that eggs of schistosoma mansoni were present in the stool, however they were not in the active stage of disease.

Specificity : 6/7 = 85.7%.

(Group) 7. -> Diarrhoea with Weight loss ?Cause.

One of the 6 cases in this group was missed by



barium enema examination. The missed case was one of a small polyp in the sigmoid region. As explained under category B - 2, this polyp was most likely missed due to lack of double contrast examination and poor bowel preparation.

A further clinical and laboratory check in one other case revealed malabsorption syndrome.

Specificity :  $5/6 = 83.3\%$

(Group) 8 <: ^Ulcerative Colitis.

There were 4 cases in this group and no colonic pathology was missed by barium enema examination.

Specificity S  $4/4 = 100\%$

(Group) 9 -v,yAmoebic Colitis.

A total of 4 cases came under this group. The case file check revealed that one case of amoebic colitis was missed. Although the other 3 cases had cysts of *E. histolytica* in the stool, they were not cases of amoebic colitis. The one missed case was most likely due to poor bowel preparation or observer error.

Specificity :  $3/4 = 75\%$

(Group) 10 : Hirschsprung's Disease.

There were only 2 cases in this group and no pathologic condition was missed. The case files indicated that the 2 were cases of chronic constipation.

Specificity :  $2/2 = 100\%$

(Group) 11 : Polyps.

The case files of the 2 cases in this group indicated that there was no colonic pathology missed on barium enema examination. The files revealed that both cases were later discharged from the clinic.

Specificity :  $2/2 = 100\%$

Comment.

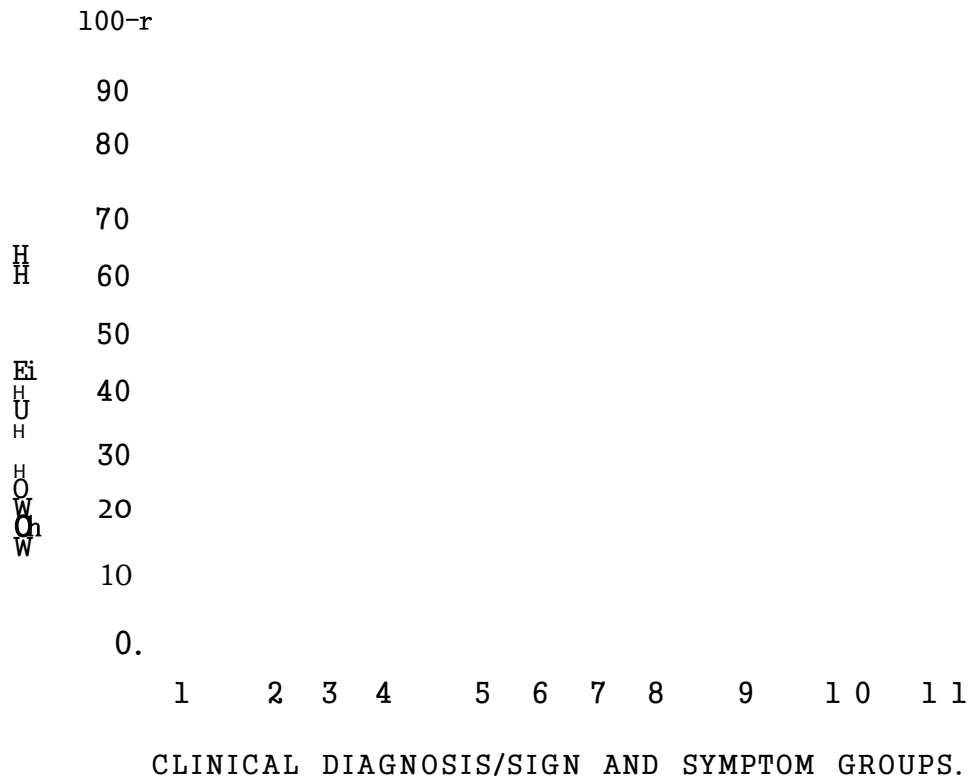
From the eleven groups which appeared to be radiologically normal on barium enema examination, seven cases were found to have been missed. The

specificity of each group varies although the range is narrow. This is displayed on the histogram in

- Figure 5»

FIGURE 5.

Histogram of the Specificity of Barium Enema Examination  
in this Study.



Overall, barium enema examination gave a true negative in 177 of the 184 cases passed as normal.

Specificity in this study :  $177/184 = 96.2\%$

Comment.

In this series, a negative barium enema examination is shown to have a 96.2% chance of being correct and in this respect is a satisfactory examination. However, this disregards the poorly prepared cases, nor does it suggest that all the 177 true negative cases were correctly requested on clinical grounds. If the cases selected for barium enema examination had little clinical indication, then the apparent specificity will be high.

In this study done at Kenyatta National Hospital, Kenya, the total number of cases found to be normal in the final analysis were 177 which is 66.8% of the 265 cases studied. A similar study of 1,040 cases done in Manitoba, Canada gave a final diagnosis of normal in 714% of the

At either centre, the percentage of cases that finally turn out to be normal is high. This does not however, mean that their examinations were requested unnecessarily.

D I S C U S S I O N

This study has been conducted in various categories under which large bowel diseases fall radiologically. The discussion of the various results will follow much the same pattern as the result analysis.

The congenital lesions, which were aganglionicosis and idiopathic megacolon, formed the highest percentage of large bowel pathology as seen in this study at Kenyatta National Hospital. The clinician's accuracy in the diagnosis of aganglionicosis was very high. On the other hand, the clinician's diagnosis of idiopathic megacolon was poor; perhaps because of its similarity to aganglionicosis in clinical presentation; and its low prevalence at Kenyatta National Hospital. As such it was confused for aganglionicosis clinically.

Barium enema examination had a very high sensitivity rate in the diagnosis of both congenital lesions, but there was a 6.2% chance of confusing aganglionicosis for idiopathic megacolon. This chance is most likely 'si the low segment type of aganglionicosis in which the narrowed segment is not easily demonstrable on enema examination.

All the patients who had congenital lesions, as seen on barium enema examination in this study, had corrective

surgery done and follow up reports showed that they were well, reflecting a high efficacy of the examination,

- There was also, 100% specificity rate as no congenital lesion was missed by the examination. Cases in this category had a sex ratio of 2 : 1 male to female; a ratio which compares well with the work done by

(02)

Soroosh in a study of Hirschsprung's disease by barium enema examination.

Cases with mass lesions as may be expected, were less clear-cut in their presentation to the clinicians. The clinicians made too many suspected diagnoses of carcinoma of the colon. Many of these turned out to be normal and others were of other mass lesions such as adenoma or schistosomal granuloma. However, in cases for which the clinicians gave a confident diagnosis of colonic carcinoma they were right in 50% of the cases. It was also observed that most of the "rule out" or "suspected" requests were not from senior consultants, but from registrars or interns. This may seem an obvious expectation, but it is an important observation with regard to the objectives of this study. If the junior doctors had consulted the seniors before requesting for the barium enema examination, the number of requests would have reduced by half.

Barium enema examination diagnosed carcinoma of the

colon with a sensitivity of 75% and a false negative rate of 1.6%. This is satisfactory, given that other mimicking colonic lesions do occur and to differentiate them with confidence can be difficult.

10 of the 16 confirmed cases of colonic carcinoma had operations. The other 6 were in the inoperable stage. 61 cases had had barium enema examinations because the clinicians had suspected carcinoma of the colon. Only 10 (16.4%) benefited from the examination in this respect.

The pattern of distribution showed that 68.8% of colonic carcinoma cases had carcinoma in the rectosigmoid region. This compares well with the figure of 66.7% given by Dreyfuss, et al., in their work. In this series at Kenyatta National Hospital, 81.3% of the malignant neoplasms seen were between the splenic flexure and the rectum - a region easily accessible by sigmoidoscopy. This means that if appropriate sigmoidoscopy and biopsy were done, 13 cases need not have had barium enema examination. As noted, the commonest examinations done by the clinicians prior to requesting enema examination were proctoscopy or per rectal examination.

Only 9 cases of polyps were confirmed in this study. The clinicians failed to diagnose or suspect 77.8% of the

cases. This was not surprising since polyps are known to be asymptomatic in most cases unless they bleed, ulcerate, block the colon or turn malignant (2, 8).

The sensitivity of barium enema examination in diagnosing polyps was 66.6%. This rate was poor, particularly when compared to the work done by De Roos who compared the sensitivity of double and single contrast examination in detecting colonic polyps. His series had a sensitivity rate of 89% for double contrast studies and 54% for single contrast studies. It is evident from this that double contrast studies are mandatory for a high sensitivity rate in the diagnosis of polyps. At Kenyatta National Hospital double contrast studies are not routinely done. Proper bowel preparation is also very important as emphasised by Cargil, et al. (8)

The efficiency and the efficacy of barium enema examination in the diagnosis of polyps was found to be low. Of the 9 cases, 5 could have been easily diagnosed by sigmoidoscopy as they were within reach. However, it cannot be considered entirely unnecessary to do a barium enema examination of a case in which sigmoidoscopy has shown a polyp. One needs to rule out the presence of those beyond the reach of the sigmoidoscope such as in the caecum. In the pattern of those seen in this study, there were 2 familial and 7 solitary type. No malignancy



was reported in any.

Clinicians made a 60% correct diagnosis of the 5 confirmed cases of amoeboma. Given that 50% of the 5 cases had a past history of *E. histolytica* in stool, the clinicians diagnostic accuracy should have been higher; amoeboma being a first diagnosis then followed by carcinoma as a second differential.

Barium enema examination had a sensitivity rate of 80% in the diagnosis of amoeboma. The 20% false negative was a case in which carcinoma was suspected as the diagnosis. If the radiologist had been given full clinical details on the request form (rarely the case at Kenyatta National Hospital), he would have been in a better position to make a confident diagnosis.

Under schistosomal granuloma the clinicians suspected or made a diagnosis in 10 cases, but histology confirmed only 4 cases. This "over diagnosing" could be because of the finding that all 10 suspected cases had a past and recent history of *Schistosoma mansoni* eggs in the stool. The presence of *S. mansoni* eggs should not lead to thinking of schistosomal granuloma even if the patient presents with other abdominal symptoms. With modern chemotherapeutic agents, very few cases get a chance to develop into granuloma. However, schistosomal colonic polyposis can

occur . Barium enema examination had a sensitivity rate of 75% but only confirmed the suspicions of the , clinicians. Apart from showing the site of fibrosis, there was nothing new it contributed. Chemotherapeutic agents could still have been given and only in resistant cases where surgical resection was needed would the surgeons have used the films to view the site to be resected. In addition, all the lesions were in the left colon which is accessible by sigmoidoscopy.

In diverticulosis, the clinician's accuracy of its diagnosis had a rate of 50% with a 30% false positive rate. These low rates are probably due to the fact that most of the diverticulae were asymptomatic. This together with the lack of a clear clinical sign and (25) symptom combination reduced the clinician's accuracy . Indeed many of the diverticulae were merely incidental findings.

Barium enema examination had a sensitivity of 90% in the diagnosis of diverticulosis. The age pattern was similar to that described in other works. It occurs in the older age group - over 41 years<sup>1</sup> ; and the male to female ratio was 1:1.

Pre-diverticular disease is asymptomatic most of the time and is usually an incidental radiological diagnosis.

Clinicians had requested barium enema examinations for patients who fell under this section because of the symptoms they had presented with. The diagnostic sensitivity of barium enema examination was 100%. The 10% false positive was due to observer error.

Irritable bowel syndrome is a disease with bizzare clinical symptoms. The clinicians diagnosed only 5 true cases and 9 false positive cases. Barium enema examination had a sensitivity rate of 100% but with a 4056 false positive rate.

The high rate of false positive cases in the diagnosis of irritable bowel syndrome would suggest that care must be taken to avoid false detection of this disease. It is commonly a disease of the stressed and the anxious young adults with a slight preponderance to females^^ .

It may be said that it is efficacious to do a barium enema examination for a suspected case of irritable bowel syndrome because it altered the clinician's diagnosis in 9 out of the 14 suspected cases in this study at Kenyatta National Hospital. However, the 5 true cases were still going to get the necessary treatment with or without the examination. Even on the best treatment available, these patients are difficult

to cure and they have a high rate of relapse symptomwise<sup>v</sup> . The efficacy is thus regarded as low.

Clinicians did not diagnose or suspect any of the 3 cases of cathartic colon. Barium enema examination had a sensitivity rate of 100% but with a 33.3% false positive rate: the latter perhaps due to observer error. All 3 cases were found among the cases which were investigated because of ?ulcerative colitis (see below). One could say that they were incidental findings.

(3c)

According to the work done by Urso<sup>v</sup> , the main problem the radiologist of today faces is the differentiation of cathartic colon from ulcerative colitis, because they simulate each other very much.

Ulcerative colitis was diagnosed by barium enema examination with a sensitivity of 100%. The clinicians had requested examinations to rule out the disease. Histology confirmed the 2 cases diagnosed by barium enema examination. It is worth noting here that the 3 cases of cathartic colon were found among the 10 with ?ulcerative colitis. The clinicians had too many false positive cases.

There were 3 cases of rectovaginal fistula (R.VF) all of which were confirmed by barium enema examination. Diagnostic sensitivity was 100% both clinically and

radiologically. The question here is, "was barium enema examination really necessary to diagnose the rectovaginal fistula?" The answer is NO! A rectovaginal fistula is blatantly obvious and does not require an enema examination. The three investigations were totally unnecessary.

Clinicians diagnosed intussusception with an accuracy of 66.7%\*. Barium enema examination had a diagnostic sensitivity of 100% and also reduced the intussusception. This can be considered as an efficacious and efficient procedure.

There were 61 cases of poor bowel preparation which made requests for repeat examinations necessary. There was evidence of 5 cases repeated. A barium enema examination at Kenyatta National Hospital costs K.Shs.300/-. Therefore, in terms of cost, (69 x 300/-) K.Shs.20,700/- was wasted because of poor bowel preparation and consequent repeat examinations. This money is enough to repair a lot of minor breakdowns of the major X-ray units at Kenyatta National Hospital which sometimes cause them to halt. In this case the money was a sheer waste because of the low standards of bowel preparation at the Kenyatta National Hospital.

From the clinical presentation,

the following are regarded as barium enema examinations which should not have been done.

- (1) 3 cases of obvious rectovaginal fistula.
- (2) 10 cases of suspected schistosomal granuloma:  
sigmoidoscopy and good laboratory and clinical investigations could have been adequate.
- (3) 13 cases of carcinoma colon in the left side of the colon: good sigmoidoscopy is adequate.
- (4) 31 cases of chronic constipation ?cause: good case history will reveal stress and anxiety associated with modern living.
- (5) 8 cases of ?irritable bowel syndrome: better diagnosed clinically with good case history than by barium enema examination.
- (6) 80 cases of vague lower abdominal pain ?cause:  
in females these pains are usually traceable to genital organs and to the bladder, ureter, etc.,  
in males,

145 cases in total.

The list could continue, but it is felt that the above were those which were really unnecessary barium enema examinations. They could have been avoided if the

referring clinicians had been a little more thorough in their investigations.

Thus, from the 265 barium enema examinations studied at Kenyatta National Hospital, 145 could have been avoided and reduced the number of examinations by 54%\*  
Considering cost, this would have saved the hospital a total of Kshs.43,500/-. This is a conservative figure disregarding the films which could not be traced.

CONCLUSION AND RECOMMENDATIONS

For diagnostic radiology, it is not possible to make  
(37)  
a perfect selection of patients<sup>v</sup> ' , However, the  
conclusion and recommendations made here will help in  
reducing the rate of unproductive use to a minimum.

Nearly all patients who attend Kenyatta National  
Hospital for barium enema examination are referred by  
clinicians who make their decision according to the  
patients<sup>1</sup> signs and symptoms. As shown in the results of  
this study, certain colonic diseases have such classic  
sign and symptom combinations that if evaluated well by  
clinicians, unnecessary requests for barium enema  
examinations would be reduced significantly. At the same  
time, certain symptoms are so vague that on their own,  
they should not warrant a request for barium enema  
examination. An example here would be the 31 cases of  
chronic constipation ?cause in this study which were  
found to have no colonic pathology. There are cheaper  
and non-radiation producing procedures that can be used  
to make accurate diagnoses in such cases.

The following recommendations are deemed necessary?

- (1) Clinicians should have more frequent consultations  
with radiologists in order to make the best use of  
barium enema examination; if not all radiological



examinations.

- (2) Clinicians should do all the necessary diagnostic procedures and be quite sure that by requesting barium enema examination, added information beneficial to the patient will be found.
- (3) The radiologists who make the bookings for specialised examinations, barium enema examination included, should scrutinize the clinical information on the request form. If in his or her opinion the information is inadequate (commonly the case at Kenyatta National Hospital), or irrelevant, the booking should not be made and the referring clinician consulted.
- (4) A control film of the abdomen to check for adequacy of bowel preparation, although it may not be very accurate, should be taken just before the barium enema examination is done. The procedure is done routinely for all intravenous pyelograms performed at Kenyatta National Hospital with very useful results.
- (5) Bowel preparation should be thorough, for more efficient examinations, as done in most European and American X-ray centres. They use castor oil as

an aperient and a cleansing enema is given just before the barium enema examination is done.

Using such measures would be less costly than having many cases with poor quality films due to « poor bowel preparation. More importantly, poor bowel preparation can lead to misdiagnosis of serious colonic lesions with serious consequences.

- (6) The radiologists, when in doubt, should always be humble to seek opinion from a colleague rather than committing themselves to a wrong diagnosis that could have adverse effects on the subsequent patient management.
- (7) Last but not least, up-to-date maintenance of equipment or complete replacement of old ones is a mandatory requirement.

Although drawn from a study of only one aspect of a radiodiagnostic procedure, it is hoped that some of these recommendations will find applications in all other radiodiagnostic procedurer-.

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