Are Oral Cathartics of Value in Optimizing the Gallium Scan?

Concise Communication

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The normal intestinal secretion of 9–15% of an administered dose of gallium-67 may prevent early detection of intra-abdominal disease. We randomized 50 patients to receive either no bowel preparation or 30 cc of milk of magnesia plus 5 cc of cascara. No significant difference was found between the two groups in frequency with which gallium interfered with readings or time to complete the study.

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Although gallium-67 imaging has become an accepted technique in diagnosing inflammatory and neoplastic disease, the normal intestinal excretion of 9–15% of this tracer (*1*,*2*) limits its applicability where rapid diagnosis of intra-abdominal disease is required. Imaging must often be delayed up to 72 hr or longer if no bowel preparation is used (*3*), and the patient's condition may require therapeutic intervention before that time. However, false-positive results from delayed abdominal imaging have been noted with (*4*,*5*) or without (*3*) bowel cleansing. A preliminary retrospective study by Zeman and Ryerson (*6*) suggested that a bowel preparation involving three 5-mg bisacodyl tablets on each of 3 nights between gallium injection and scanning, with 360 ml of magnesium citrate orally on the night before the scan, did not reduce colonic gallium significantly compared with a control group, matched for age and sex, with no bowel preparation. Several questions raised by this work led us to perform a randomized prospective study to determine whether the intestinal cleansing regimen used at our medical center had any effect on the diagnostic quality of subsequent gallium images.

MATERIALS AND METHODS

Fifty patients were randomized (using a table of random numbers supervised by a technologist) to receive either no cathartic (NO-PREP group) or 30 cc milk of magnesia plus 5 cc cascara (PREP group) nightly, to begin the evening before the injection of 3–5 mCi Ga-67 citrate and continuing until the study was complete. The number of days each patient was imaged until a scan of diagnostic quality was obtained was determined by the Center's physicians, none of whom had knowledge of the bowel preparation of the patients. Before initiation of the protocol, a stratification schema for the patient's condition was agreed upon, to be certain the two groups were fully comparable in regard to ambulation, pain and narcotic use (since opiates reduce intestinal motility), fever (associated with ileus), and frequency of defecation during the study period (Table 1).

A semiquantitative rating scale for Ga-67 abdominal scans was devised (Table 2). The studies were read by two nuclear medicine physicians (with 6 and 12 yr of experience in the field) who had no knowledge of the bowel preparation applied. The readings were then tabulated to determine which group required fewer studies for diagnosis, how often the last scan attained a higher rating than the first scan, and the frequency with which intestinal gallium did not interfere with the reading. Interobserver variation was also studied.

RESULTS

The distribution of patients within the study is shown in Table 3. The only reason for elimination of patients

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TABLE 1. PATIENT CONDITION—SCALES

A. Ambulation
   1. Fully bedridden
   2. Bedridden but moves freely and is able to walk to bathroom
   3. Ambulatory outpatient
B. Pain
   1. Pain requires narcotics
   2. Pain slight, requires non-narcotics
   3. No pain
C. Fever
   1. Temperature over 99.0° P.O. or 100.0° P.R. for 24 hours;
   2. No fever
D. Bowel condition
   1. Bowel movement three or more times per week, unchanged over 6 mo
   2. Bowel movement less than three times per week without cathartic
   3. Ileus (reason: e.g., days post op) with minimal or absent bowel sounds

from either group (nonevaluable scan) was the absence of complete images of the entire abdomen on each day of scanning, when the disease-bearing area was felt to be elsewhere. The mean age and sex distribution of the two groups were entirely comparable (Table 3).

There was also no significant difference between patients in the PREP and NO-PREP groups in degree of ambulation, narcotics usage, presence of fever, defecation frequency, or underlying disease (i.e., tumor or inflammation) (Table 4).

The days of scanning required to complete the Ga-67 study did not differ significantly between the PREP and NO-PREP groups (Table 5). In Table 6 we indicate that

TABLE 2. RATING SCALE FOR Ga-67 SCANS OF ABDOMEN

(0) Zero	Background activity in the intestine makes scan reading impossible.
(1+) One plus	Moderate bowel activity seen on scan, but liver can be outlined. Some abdominal and bone structures can be distinguished from bowel.
(2+) Two plus	Mild bowel activity in scan, causing some interference or potential false-positive results. Most of abdomen is clear of gallium activity.
(3+) Three plus	Minimal bowel activity is seen but does not interfere with reading.
(4+) Four plus	No intestinal gallium activity is seen on scan.

TABLE 3. DESCRIPTION OF POPULATION STUDIED

	PREP	NO PREP
No. of patients	24	26
Mean age and standard deviation	50.2 ± 4.6	52.4 ± 5.1
Male/female	14/10	14/12
No. eliminated because abdomen was not fully imaged on every scan	3	2
Evaluable	21	24
No. of studies on evaluable patients	49	60
No. with only one evaluable study	4	3

the two readers found that only in about one third of the scans was a higher rating score attained on the last scan compared with the first, with no significant difference between readers. Similarly each reader found no difference between the two groups in the frequency with which intestinal gallium interfered with the reading. Within each group, however, there was an inter-reader difference as to whether intestinal gallium imposed the threat of a potential false-positive reading. This occurred simply because one physician tended to rank more scans with a 3+ reading than the other. It will be recalled that for a 2+ reading on our scale the possibility of bowel activity interfering with the reading was raised, but a 3+ score indicated no such interference. If, however, one examines the number of studies where there was either total reader agreement or a difference of no greater than 1 rank order between readers, there is a high degree of inter-reader concurrence (Table 6), well within the usual range of interobserver variation, as recently reviewed by Koran (*7*).

DISCUSSION

The design of the study differs from a previous one (*6*)

TABLE 4. COMPARISON OF NO-PREP AND PREP POPULATION

	NO PREP	PREP
Ambulation (mean ± s.d.)	2.31 ± 0.74	2.29 ± 0.81
Pain (mean ± s.d.)	2.27 ± 0.72	2.08 ± 0.72
Fever (mean ± s.d.)	1.56 ± 0.50	1.71 ± 0.46
Bowel condition (mean ± s.d.)	1.61 ± 0.46	1.46 ± 0.72
Search for tumor	15	16
Search for inflammation	13*	10*

* Two cases where both diagnoses were considered.

TABLE 5. DAYS OF SCANNING REQUIRED TO COMPLETE STUDY

	PREP	NO PREP
1	5(23.8%)	3(12.5%)
2	8(38.0%)	11(45.8%)
3	5(23.8%)	5(20.8%)
4	2(9.5%)	5(20.8%)
5	1(4.8%)	

in several areas. Ours was a double-blind prospective study. We examined the two patient groups to be sure they were similar, not only for age and sex but also for other factors relating to intestinal motility, including degree of ambulation, opiate use, fever, and degree of constipation.

Although our laxative combination differed from that of Zeman and Ryerson, our conclusions are identical: that orally administered bowel preparations given each day during the study had no effect on the degree to which intestinal gallium interfered with or delayed the final reading.

A recent paper suggests that oral magnesium citrate, followed by two phenolphthalein tablets and two effervescent suppositories plus an increased fluid intake, give better bowel preparation than either two 20% soap-suds enemas or three bisacodyl tablets the night before the scan and a 10-mg bisacodyl suppository 3 hr before the scan (*8*). However, the report offers no information to suggest that the three groups studied were comparable in all the parameters we examined, and does not indicate the reproducibility of criteria for rating the scans. In fact, most were outpatients "who did not have a contraindication to vigorous bowel cleansing." Furthermore the option of no bowel preparation was not examined (*8*).

Data have recently appeared suggesting that, in the rat, 60% of fecal gallium comes from small intestine, 20% from bile, 10% in colonic secretions, and another 10% from the esophagus and stomach (*9*). Another group has reported no difference in fecal gallium excretion with or without bile-duct ligation, although no bile was measured directly and the group with ligated bile ducts excreted 20% as much fecal gallium in the first 24 hr (*10*). Thus a proper bowel preparation would have to act throughout the intestine for a prolonged period of time. Milk of magnesia (a 7.0–8.5% solution of magnesium hydroxide) and magnesium citrate are cathartics that retain water in the intestinal lumen by osmotic forces and should provide a "cleansing" action throughout the intestine. Bisacodyl and phenolphthalein (both diphenylmethane cathartics), effervescent suppositories (which release CO_2 to distend the rectum), cascara sagrada (an anthroquinone), and soap-suds enemas all have effects primarily on the large intestine (*11*). It is difficult to see why the various combinations of osmotic diuretics plus stimulators of the large intestine should give different results with identical physiology.

We conclude that daily oral administration of milk of magnesia and cascara does not visibly speed the removal of gallium from the intestine, improve scan quality, or reduce the number of days required to obtain a diagnostic scan. We have not examined the effect of a combination of daily oral cathartics and enemas but believe this combination could be deleterious to the patient. Accordingly, we have discontinued intestinal preparation of patients for gallium scanning.

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TABLE 6. EFFECT OF BOWEL PREPARATION

	PREP		NO PREP	
	Reader 1	Reader 2	Reader 1	Reader 2
No. of studies attaining a higher final scan rating over time than on first scan (%)	5(29.4%)	7(33.3%)	7(33.3%)	8(38.1%)
No. with a final rating where gallium did not interfere with reading	5(23.8%)	11(52.4%)	4(16.7%)	11(45.8%)
No. of studies with reader agreement either in same rating or within 1 rating (%)	41(84%)		50(83%)	

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