

Gallstones after ileostomy and ileal resection¹

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SUMMARY One hundred and eight patients with ileostomies were investigated for cholelithiasis at routine annual review in a large Ileostomy Clinic. Gallstones were demonstrated in 24.5%, which is three times the incidence that might have been expected in a population of this age and sex distribution. The frequency of cholelithiasis was significantly increased in those patients who had lost more than 10 cm of ileum at operation, regardless of whether the primary condition had been ulcerative colitis or Crohn's disease. It was significantly increased in those patients who had had a resection of less than 10 cm of ileum if the original condition had been Crohn's disease, but not if it had been colitis.

Loss of functioning ileum due to disease or surgical excision is now known to have an adverse effect on the enterohepatic circulation of bile acids, with a consequent predisposition to the development of gallstones (Heaton and Read, 1969; Cohen *et al.*, 1971; Dowling *et al.*, 1972). In these series however, the amount of ileum removed was very considerable, varying from not less than 30 cm to as much as 3 m. In addition, the large bowel remained in continuity in most cases and no attempt was made to correlate the incidence of gallstones and the disease process affecting the ileum or for which ileal resection was required. During the performance of a complete proctocolectomy (or subtotal colectomy) with ileostomy for inflammatory bowel disease a variable amount of terminal ileum is usually excised, ranging from 5 or 10 cm in most cases of ulcerative colitis to 30 or 40 cm in many cases of Crohn's disease. We have under our care a large number of patients who have been subjected to this form of surgical treatment. It occurred to us that it might be instructive to determine the incidence of gallstones in these patients with particular reference to the possible influence of the amount of ileum removed and of the nature of the underlying disease for which operation had been performed.

Methods

Over a nine month period 138 patients, who had had ileostomies established more than one year previously, were seen for routine annual review in the Ileostomy Clinic of the General Infirmary at Leeds.

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Thirty of these patients were either unwilling or unable to participate in the study, usually because of the distance they lived from Leeds. Table 1 gives details of age, sex, and disease distribution for the 108 patients who took part in the survey. Full clinical, operative, and pathological data were available for each patient. In particular, the operating surgeon routinely examined the gallbladder for stones and measured the length of the ileum resected. In none of the 108 patients studied were stones palpated nor was the gallbladder thought to be diseased. The histological diagnosis of the primary disease was ulcerative colitis in 72 of the cases, Crohn's disease in 35, and polyposis coli in one.

EVIDENCE OF CHOLELITHIASIS

The survey for cholelithiasis in these 108 patients consisted of interrogation regarding symptoms referable to the biliary tract and radiological examination. Four patients gave a history of cholecystectomy having been performed for gallstones since ileostomy. The remaining 104 patients, who were all free of symptoms referable to the biliary

Age group (yr)	Total number			Number with stones		
	M	F	T	M	F	T
10-19	3	2	5	0	0	0
20-29	8	8	16	1	1	2
30-39	9	17	26	1	5	6
40-49	11	11	22	0	3	3
50-59	8	12	20	2	5	7
60-69	6	9	15	2	4	6
70-79	1	1	2	1	1	2
Total	46	60	106	7	19	26

Table 1 Gallstone incidence by age and sex

tract, were submitted to cholecystography, using a standard technique with sodium ipodate as the contrast medium. The x-ray plates were all interpreted by an independent group of radiologists who were unfamiliar with the patients or their histories.

Each cholecystogram was judged to be normal or to show faint visualization, non-visualization, or cholelithiasis. The diagnosis of non-visualization was made only when sodium ipodate was ingested at an appropriate time and no gallbladder shadow was discernible. A single non-visualization of the gallbladder in these circumstances was considered to represent disease (Whitehouse, 1955; Baker and Hodgson, 1960). Whether or not non-visualization can be equated with the presence of gallstones is debatable, as precise figures are not available, but most surgeons feel that the great majority of diseased gallbladders do in fact contain gallstones.

COMPARISON GROUP

It was neither practicable nor possible to conduct a case control study. Instead, therefore, we have had to resort to the less satisfactory expedient of using large scale necropsy series to calculate how many patients might be expected to have gallstones in a group matched for sex and age with our group of ileostomists (Table 2). Two of the necropsy surveys which we have consulted have been from Leeds itself (Gross, 1929; Watkinson, 1967). Unfortunately, they both suffer the disadvantage of being based on cases that were collected more than 20 years ago, so that they might be criticized as not reliably reflecting the incidence of gallstones at the present day. Of the more recent necropsy series in the literature reporting the incidence of gallstones in the general population, only that from Oslo (Torvik and Høivik, 1960) was from a Western European city of a size comparable with Leeds. Series published a few years later were inadequate in numbers (Sternby, 1968), came from two widely differing cities (Zahor *et al.*, 1974), or failed to distinguish between males and females in each 10 year age group. The frequency of gallstones which might be expected in the group of patients studied is very similar whichever of the necropsy series chosen is taken. Incidentally, Watkinson excluded patients who had

had cholecystectomy; we have, therefore, added 7.7% to his estimates, for this was the proportion of cholecystectomies in the Oslo series. In Tables 4-7 comparing observed and expected frequencies with regard to age, sex, amount of ileum resected, and nature of disease process, the expected figure for each group is the mean of the figures calculated from each of the three necropsy series.

Results

OVERALL INCIDENCE OF GALLSTONES

Of the 108 ileostomy patients studied, 80 were reported as having normal cholecystograms without gallstones. Twenty-four patients exhibited various abnormalities. Five patients had radio-opaque stones, 14 had radiolucent stones (eight single) and in three patients the gallbladder was said to be non-functioning. In one patient, visualization was reported as being faint and, in another, the diagnosis of adenomyomatosis of the gallbladder was made. We have decided to exclude the latter two cases from the study as the significance of these findings is not yet established. Combining the four cases who had undergone cholecystectomy with the 22 x-ray positive cases, there are a total of 26 cases with proven gallstones out of a series of 106 ileostomy patients—an incidence of 24.5% overall (Table 3).

Using the three necropsy series referred to, the expected incidence of gallstones in 106 patients of this age and sex distribution is between seven and nine (Table 2). The difference of the observed from the expected incidence is statistically highly significant (χ^2 8.80 $P < 0.005$).

INFLUENCE OF AGE AND SEX

From the necropsy data, the expected frequency of gallstones in our patients was 2.1% for those aged under 40 years and 13.4% for those aged over 40. A striking feature in the present study is the greatly increased incidence of cholelithiasis in the younger age group (Table 4), with stones demonstrated in 17.1% of cases under the age of 40 years as against 30.5% of cases over that age. Stones were found in

Observed number in this study	26
Expected number	
According to Gross (1929), Leeds	9.571
According to Watkinson (1970), Leeds	8.853
According to Torvik and Høivik (1960), Oslo	7.628

Table 2 Comparison of observed number of cases with gallstones with number that might be expected in group of patients of similar age and sex composition according to published necropsy series

Cholecystogram	No.
Normal	80
Abnormal	24
Radio-opaque stones	5
Radiolucent stones	14
Non-functioning gallbladder	3
Faint visualization	1
Adenomyomatosis	1

Table 3 Findings on cholecystographic survey of 104 ileostomy patients

seven of the 46 men (15.2%) and 19 of the 60 women (31.7%) (Table 5). The female:male ratio of incidence of approximately 2:1 in this series remains similar to that in the general population.

INFLUENCE OF TIME ELAPSED SINCE OPERATION

Heaton and Read (1969) found that the incidence of gallstones due to ileal resection or disease seemed to increase the longer the time that had elapsed since operation. But, as Table 6 shows, in our series, after the first year, the frequency of cholelithiasis did not appear to rise with the passage of time.

SIGNIFICANCE OF EXTENT OF ILEAL RESECTION AND NATURE OF PRIMARY DISEASE

All 106 cases have been divided into two groups according to whether more or less than 10 cm of ileum had been removed before, after, or at the time of ileostomy. This figure was chosen as being the most common dividing line between the minimal ileal resection undertaken for technical reasons in the standard proctocolectomy and ileostomy (Goligher, 1975) and the greater resection under-

taken for disease involving the ileum or for vascular insufficiency or trauma at the time of operation. Each of these two groups was again subdivided according to whether the primary disease was ulcerative colitis or Crohn's disease. In the group with a resection of more than 10 cm, the amount of ileum excised varied from 12 cm to 2 m with a mean of 56 cm ± 10 cm. In this group, there is little difference in the incidence of gallstones between those patients whose original lesion was ulcerative colitis and those who had had Crohn's disease—six out of 18 (33.3%) against seven out of 22 (31.8%). But in those patients who had less than 10 cm of ileum removed there is a very marked difference in the frequency of gallstones depending on the nature of the primary condition, for cholelithiasis was found in only eight (or 14.8%) of the 54 patients who had colitis but in five (or 45.4%) of the 11 who had had Crohn's disease (Table 7). The increased incidence

Patients' age (yr)	Observed incidence		Expected incidence (mean of 3 series)	
	Number surveyed	Number with gallstones (no.) (%)	(no.)	(%)
< 40	47	8 17.0	1.005	2.1
> 40	59	18 30.6	7.924	13.4

Table 4 Observed and expected incidence of gallstones according to age of patients

Sex	Observed incidence		Expected incidence (mean of 3 series)	
	Number surveyed	Number with gallstones (no.) (%)	(no.)	(%)
Male	46	7 15.2	2.443	5.3
Female	60	19 31.7	5.811	9.7

Table 5 Observed and expected incidence of gallstones according to sex of patients

Years since ileostomy performed	Patients surveyed (no.)	Patients with stones (no.)	(%)
1	12	2	16.7
> 1-5	36	10	27.8
> 5-10	33	9	27.3
> 10-15	21	4	19.1
> 15-20	4	1	25

Table 6 Observed incidence of gallstones according to lapse of time since ileostomy performed

Amount of ileum resected, and original disease	Patients surveyed (no.)	Incidence		Ratio observed to expected incidence
		Observed (%)	Expected (%)	
> 10 cm				
Ulcerative colitis	18	33	10	3.2:1
Crohn's	22	32	5	6.8:1
< 10 cm				
Ulcerative colitis	54	15	9	1.6:1
Crohn's	11	45	9	4.9:1

Table 7 Observed incidence of gallstones according to disease and length of ileal resection

of gallstones over what might have been expected in comparable series of the ordinary population is statistically significant in each group, other than in those patients who had undergone minimal ileal resection during standard proctocolectomy and ileostomy for ulcerative colitis. In each group the calculation of an 'observed:expected' ratio avoids any confusion which might arise from the differing sex and age distribution in the various groups.

Discussion

This survey has uncovered the existence of gallstones in 26 of 108 patients attending the Ileostomy Clinic of the Leeds General Infirmary for routine yearly review. Calculation of the expected incidence of gallstones in such a group of 108 patients from necropsy data (Table 2) is less than ideal. Mainland (1953) has pointed out the possible fallacies of statistical conclusions of this kind drawn from hospital patients and particularly from necropsy cases. However, in the necropsy surveys used to calculate the expected incidence of gallstones, strenuous efforts were made to minimise the in-

adequacy of the data. It might be argued that the two Leeds surveys were carried out many years ago and that the incidence of gallstones in this area of the country may have since increased. Comparison between the two surveys, however, suggests that, if anything, the incidence of gallstones is slightly less in the more recent report (Watkinson, 1967).

The finding of a high overall incidence of gallstones in ileostomy patients is somewhat surprising, for long-term studies of groups of patients with ileostomies have not shown a large number of patients requiring cholecystectomy (Goligher, 1975; Ritchie, 1972). But so far as we are aware, there has been no previous large scale cholecystographic study of a group of patients with ileostomies. On the other hand, the high incidence of gallstones (32.5%) found in ileostomy patients with an ileal resection of more than 10 cm is not unexpected, for Cohen *et al.* (1971) and Heaton and Read (1969) have demonstrated the occurrence of gallstones in 32-34% of patients with distal disease of the small bowel or after resection of this part. It is striking how similar our figures are to theirs, despite Heaton and Read's definition of 'ileal disorders' as being a lesion at least 30 cm in length and present for 18 months or more. The present report differs in that we have not shown that the frequency of cholelithiasis rises with passage of time since ileostomy, nor have we found an increased proportion of radio-opaque stones, as was noted in over 50% of their series. Our figures of five or 26.3% of cases with radio-opaque stones out of a total of 26 cases with gallstones is nearer to the 20-40% usually quoted (Sleisenger, 1967; Sherlock, 1968).

The frequency of cholelithiasis in the group who have undergone an ileal resection of less than 10 cm differs notably according to the nature of the original disease. Those who had undergone their ileostomy for ulcerative colitis show a statistically insignificant rise in incidence of gallstones, presumably because the remaining ileum is able to adapt after ileostomy to reabsorb those bile acids which might, theoretically, be absorbed from the colon in health (Mekhjian and Phillips, 1970; Morris *et al.*, 1970; Percy-Robb *et al.*, 1971). It is certainly reassuring that patients with ulcerative colitis submitted to standard proctocolectomy and ileostomy with minimal ileal resection do not seem to be exposed to any significantly increased liability to gallstones.

But those patients who have had their ileostomies with limited ileal resection for Crohn's disease exhibit a high incidence of gallstones (45.4%). It is difficult to understand why this should be. Perhaps the most likely explanation is that some of these patients with Crohn's disease may have residual or recurrent intestinal disease causing still further

malabsorption of bile acid. None show obvious clinical features suggestive of recurrence, but it is well recognized that Crohn's disease may be extremely insidious at its onset or reassertion.

It should be pointed out that of our 26 patients with gallstones only five had symptoms—the four who had had cholecystectomy before the survey was carried out, and one other whose symptoms were mild but who has since proceeded to cholecystectomy. Should the management of the other 21 asymptomatic patients be conservative or radical? We have adopted an expectant attitude to them, but appreciate that other surgeons may give a different answer to this controversial question.

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