It must be remembered that in cholecystitis the liver itself is damaged or deranged in function, and a sojourn for treatment at a spa which specializes in hepatic diseases and in the other frequent accompaniments of cholecystitis, such as obesity, may be of great value. Disordered function of the liver, so commonly associated with cholecystitis, is claimed by some to be concerned in the aetiology of migraine, but I must state that I have never seen migraine in direct association with hepatic disease.

Conclusion

In conclusion, my plea is for the more general recognition by doctors in Britain of the great frequency of cholecystitis, of the difficulties that must be faced in making a correct diagnosis, of the methods that are of real practical use in diagnosis and treatment, and of the great diagnostic value of the duodenal tube. Further, I would express my belief that catarrhal cholecystitis can be cured in its earlier stages by medical treatment, and that in this way we may hope to diminish the incidence of gall-stones with their frequent dangers and complications.

CHOLECYSTOGRAPHY: THE EFFICIENCY OF THE GRAHAM-COLE TEST*

BY

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The introduction of this method of examination by Graham and his associates in 1924 was one of the outstanding advances in radiology, and it has proved of immense assistance to physicians and surgeons. Nevertheless there are many to-day who are inclined to question the accuracy of this method of detecting disease of the gall-bladder. I believe that such incredulity is most frequently due to a very common human weakness—the disposition to allow one error in diagnosis to make a much more lasting impression on the mind than ninety-nine correct diagnoses, and so when asked whether the Graham-Cole test is reliable the answer is frequently in the negative.

A second reason is a misconception as to how much a Graham-Cole test will reveal. Some place too great a reliance upon it as an absolute proof of the presence or absence of disease, without realizing that there are some unavoidable fallacies. No radiologist would attempt to claim infallibility for this method of examination, but we do claim that the Graham-Cole test, carried out with punctilious care as to preparation of the patient, administration of the dye, and radiographic technique, will yield valuable information on the functional ability of the gall-bladder to receive and to concentrate bile containing dye. This is to some extent a measure of the functional health of the mucous membrane of the gall-bladder, and the test yields a very high percentage of correct inferences regarding the presence of disease.

It must be recognized at once that there are pathological conditions remote from the gall-bladder, such as duodenal ulcer and chronic appendicitis, which will sometimes be responsible for a failure of that organ to show a normal Graham-Cole reaction. In my opinion such an admission brings home to us the necessity for a complete radiological examination of the gastro-intestinal

tract in all cases in which the Graham-Cole test and the clinical history and signs are at variance.

In thousands of cases operation has proved that disordered function, as shown by a faint shadow or a failure to obtain any shadow, is a result of disease of the gall-bladder, and in only a very small percentage are the x-ray findings due to remote lesions. In a large majority of the cases diagnosed as pathological, one can only go so far as to say that there is complete dysfunction or impaired function.

Conditions affecting the Gall-bladder

A differential diagnosis between the conditions which may affect the gall-bladder is only possible in a comparatively few cases. Stones containing not less than 10 per cent. of calcium will be demonstrable on an ordinary film without the introduction of any opaque dye. Bilirubin stones are also radiopaque. They may be obscured by the dye, only appearing when evacuation has occurred. Cholesterol stones are translucent. If there is no obstruction of the cystic duct, and the gall-bladder mucosa is sufficiently healthy to concentrate the dye, these stones will be demonstrable as well-defined clear spaces in the opaque dye.

Papillomas and adenomas may sometimes be recognized by the marginal defects which they produce. Stones do not show such defects, but tend to lie grouped together in the centre of the gall-bladder. Multiple papillomas may give rise to negative shadows in a dye-filled gall-bladder, similar to those of cholesterol stones. Repeated films taken at intervals would show that the defects remain constant in the case of papillomas, whereas stone shadows would alter in relation to one another.

The diagnosis of carcinoma of the gall-bladder may be made occasionally, and Kirklin of the Mayo Clinic in a paper written in March, 1935, refers to a case reported by Taterka in which the tumour produced a large irregular defect along the lateral wall of the gall-bladder and in which the entire picture was analogous to that of medullary carcinoma of the stomach as exhibited with the barium meal. Such appearances in the gall-bladder must be very rare indeed, for I believe that in the majority of cases of carcinoma of the gall-bladder a well-marked defect would be accompanied by such impairment of function of the mucosa that no shadow would be obtained by the Graham-Cole test.

I find it difficult to express a definite opinion upon Professor McNee's criticism that "x rays generally do not yield information of positive diagnostic importance in the early cases of catarrhal cholecystitis." I do not know at what stage in the course of the disease the function of the mucosa would be sufficiently affected to present positive x-ray signs or the duration of time which might elapse before such an effect was produced. I think that most of the cases sent for examination are those which have been suffering from recurrent attacks of cholecystitis, but I believe that a certain number of early catarrhal cases associated with duodenitis will show delay in the emptying time of the gall-bladder. Some workers have had experience and positive proof of such cases, but Kirklin states that he does not attach much importance to delay in filling or emptying.

It is impossible to go fully into the details of technique here. Suffice it to say that the correct preparation of the patient, strict directions as to the avoidance of all food until permitted, and a careful radiographic technique are essentials for reliable results.

* Communication to the Section of Medicine at the Annual Meeting of the British Medical Association, Belfast, 1937.

Causes of Failure in Diagnosis

Fallacious findings are of two kinds: (1) A normal shadow is demonstrated and at operation a pathological gall-bladder is found; (2) no shadow is obtained and at operation a normal gall-bladder is seen.

The first type of error is usually found in association with the strawberry gall-bladder. It has been suggested by A. C. Mooney (*British Journal of Radiology*, 1935, 8, 403) that "there is always an associated cholangitis of varying degree, and this latter is mainly responsible for the resulting changes in gall-bladder structure which eventually produce disturbance in function. The cholangitis is a result of an ascending bacillary or streptococcal infection from the bowel, passing up either directly along the duct lymphatics or being blood-borne by the portal system. . . . In the more common blood-borne infection the peritoneal and muscular coats are the first to be attacked. Changes in the mucosa occur as a later development." Hence concentration of dye is not affected in the earlier stage of the disease and a radiograph may show a good gall-bladder shadow while at operation a diseased bladder is found. Kirklin states that "in approximately 10 per cent. of normal responses from patients ordinarily selected for the test the gall-bladder is nevertheless diseased." Operative findings upon 287 cases with normal gall-bladder shadows support his statements. It would seem inevitable, therefore, that there will always be a percentage of errors in those cases showing normal shadows. Statistics indicate that in this group the test is less reliable than in the pathological group where no shadow or only a faint shadow is obtained.

Now the second type of fallacy—that is, no shadow and a normal gall-bladder—may arise from different causes:

1. Defective liver function. Insufficient dye may be excreted from a cirrhotic or carcinomatous liver to give any shadow in the gall-bladder, and yet the gall-bladder may be unaffected.
2. Achlorhydria in connexion with a hypotonic stomach and duodenum may be associated with a relaxed sphincter of Oddi and too rapid emptying of the gall-bladder so that no concentration occurs.
3. Gastric stasis with consequent failure of absorption of the dye.
4. Vomiting immediately after ingestion of the dye.
5. Failure on the part of the patient to carry out instructions.
6. Chronic duodenal ulcer or chronic appendicitis.

If these extraneous causes of error can be eliminated the absence of any gall-bladder shadow or a very faint shadow can be taken as a reliable indication of disease. The actual percentage of error will vary in different clinics and with different workers. Statistics of the Mayo Clinic to which Kirklin refers in a paper written in March, 1935, gave confirmation of the x-ray diagnosis, whether positive or negative, in 95 per cent. of the cases. Dr. Lysholm of Stockholm claims that in his clinic the average error is one in a hundred.

I have tried to draw some conclusions as to the accuracy of the test in my own practice from 512 cases examined in two hospitals and in private practice during the past few years. I do not claim that these figures are extremely good, but they probably represent an average degree of accuracy. In the rush of hospital x-ray work as it is carried out to-day it is not easy to ensure that a perfect technique is always employed. With con-

stant changes in the nursing staff in the wards occasional errors in preparation occur and are difficult to avoid, and for this reason I find that the figures for private work are slightly better than those of the hospital x-ray department.

TABLE I.

Description	No.	Operated	Correct	Per cent.
Normally visualized.. ..	197	29	21	72.4
Faint shadow	92	37	31	83.7
No shadow	154	71	65	91.5
Stones.. ..	69	48	46	95.8
Total	512	185	163	88.1
Total cases reported pathological	315	156	142	91.0

Of the eight cases which gave fallacious x-ray findings in the first group small stones were found in three and gravel in one, mild cholecystitis was present in three, and in one the gall-bladder was removed but no reason was given for its removal. In all these cases the mucous membrane was healthy enough to allow of good concentration and a normal shadow.

TABLE II.—Analysis of Surgical Findings in Cases Reported "Faint Shadow"

Multiple stones	4
Single stone in gall-bladder	2
Chronic cholecystitis with stones	8
Chronic cholecystitis without stones	12
Carcinoma of liver	1
Chronic appendix. Normal gall-bladder	3
Chronic duodenal ulcer. Normal gall-bladder	3
Adhesions between gall-bladder and duodenum	3
Cirrhosis of liver	1
Total	37

TABLE III.—Analysis of Surgical Findings in Cases Reported "No Shadow"

Chronic cholecystitis. Cancer head of pancreas	1
Multiple stones	13
Single stone in gall-bladder	1
Stones in cystic duct	3
Strawberry gall-bladder	1
Chronic cholecystitis with stones	17
Chronic cholecystitis without stones	15
Carcinoma of liver	3
Chronic appendix. Normal gall-bladder	3
Chronic duodenal ulcer. Normal gall-bladder	1
Cirrhosis of liver	1
Empyema with stones	7
Adhesions around gall-bladder and cystic duct	3
Normal gall-bladder	2
Total	71

Conclusion

In conclusion I would like to say that the oral method was used in all my cases. This is capable of giving a correct indication in nearly 90 per cent. of cases as to whether the gall-bladder is normal or pathological. The fact that 10 per cent. of errors may occur is good reason for urging that the Graham-Cole test should not be used to supplant the usual clinical methods of examination but should take its place as part of the ordinary routine investigation as a valuable aid in the diagnosis of cholecystic disease. It should be remembered that the test is essentially a functional one, and in only a small percentage of cases can a differential diagnosis be made. The success of the method depends upon the most careful attention to detail in preparation and to correct radiographic technique.