

nephrosis also conforms to the predominance in this condition of the accidents in the use of pyelography. The majority, if not all, of these accidents are due primarily to the structural phenomenon of pyelovenous back flow.

## ROENTGENOLOGIC EXAMINATION OF THE GALLBLADDER

PRELIMINARY REPORT OF A NEW METHOD UTILIZING THE INTRAVENOUS INJECTION OF TETRABROMPHENOLPHTHALEIN \*

EVARTS A. GRAHAM, M.D.  
AND  
WARREN H. COLE, M.D.  
ST. LOUIS

The revolutionary effect on the diagnosis of gastrointestinal conditions which was made possible by the use of the opaque meal has given rise repeatedly to the idea that if, by some means, an opaque substance could be safely introduced into the gallbladder so that its contour could be seen with the roentgen ray, the diagnosis of many obscure and doubtful cases of cholecystitis might be made easy and accurate. To fulfil the necessary practical requirements, the opaque substance must be something that is excreted into the bile after being injected either subcutaneously or intravenously or after being given by mouth; and, furthermore, it must be devoid of toxic effects when used in the concentrations necessary for the shadow of the gallbladder to be seen. The extensive use of various dyes in the search for a test of liver function has revealed the fact that certain ones are excreted almost entirely into the bile, as, for example, tetrachlorphenolphthalein and rose bengal. Preliminary tests of intravenous injections of the sodium salt of tetrachlorphenolphthalein into experimental animals failed to reveal satisfactory roentgen-ray shadows of the gallbladder. Because of the similarity of chemical structure, it was thought that tetra-iodophenolphthalein would also be excreted into the bile and might cast a satisfactory shadow because of its iodin content. Roentgen-ray shadows of the gallbladder were revealed, but the substance seemed to be too toxic to permit its extensive use in man. Accordingly, it was felt that tetrabromphenolphthalein might be a suitable compromise between the toxic iodin com-

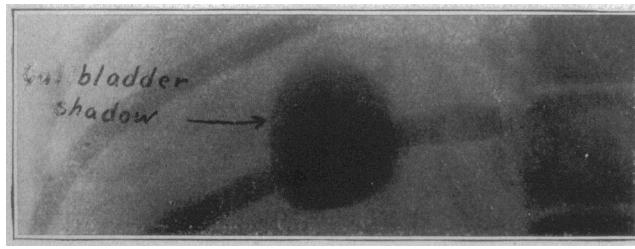


Fig. 1.—Gallbladder shadow in a 5.25 kilogram dog, twenty-four hours after intravenous injection of 1.5 gm. of tetrabromphenolphthalein with 0.3 gm. of calcium hydroxide.

pound and the less opaque chlorin compound. The experimental results with this substance were satisfactory so far as toxicity was concerned but in some instances the shadows of the gallbladder were not so definite as was desired.

\* From the Department of Surgery, Washington University Medical School and Barnes Hospital.

It was therefore decided to try the calcium salt instead of the sodium salt of tetrabromphenolphthalein. This substance, when injected intravenously, has given definite and cleanly cut shadows of the gallbladder both in experimental animals and in human subjects. No untoward effects have been observed in the human subject with the concentrations used. This preliminary report is made merely to introduce the method. As yet, our observations have been too few to permit conclusions based on the interpretation of what should constitute the normal shadow and the precise interpretation of deviations from the normal shadow. It is possible, also, that some other substance will prove to have advantages over calcium tetrabromphenolphthalein. Further work is now in progress along this line.

### METHOD

A dose of 0.25 gm. of the dye per kilogram of body weight was found sufficient to cast a shadow of the gallbladder, when injected intravenously into a rabbit



Fig. 2.—Appearance of a human gallbladder, twenty-four hours after intravenous injection of 5 gm. of tetrabromphenolphthalein with 1 gm. of calcium hydroxide. The patient weighed 130 pounds (59 kg.).

or dog with 0.05 gm. of calcium hydroxide per kilogram. A shadow could likewise be obtained by combining the dye with twice as much strontium hydroxide as calcium hydroxide.

A dose of 0.1 gm. per kilogram, when injected into a human subject, was found sufficient to cast a shadow. At present, 6 gm. has been the largest dose used. Six grams of tetrabromphenolphthalein is mixed with 1.2 gm. of calcium hydroxide, ground in a mortar with a few cubic centimeters of water, and dissolved in from 325 to 350 c.c. of distilled water. Addition of calcium lactate was found to produce a more stable solution and slightly increase its solubility. Therefore, a solution of 2 gm. of calcium lactate in a few cubic centimeters of water is added. The solution has been sterilized by heating it to the boiling point under a flame, and heating in a water bath at from 95 to 100 C. for fifteen minutes. Occasionally, a small amount of the calcium salt precipitates on the bottom of the receptacle. This dissolves readily on the addition of a small amount of water or saline solution, after the clear

solution is decanted off. The solution is filtered and given intravenously by the gravity method, similar to an arsphenamin injection. The solution is introduced slowly. Usually from twenty-five to thirty minutes is consumed in the injection, so that symptoms, if present, can be detected early. Roentgenograms of the gallbladder region are taken at intervals of several hours, beginning three hours after the injection. The patient

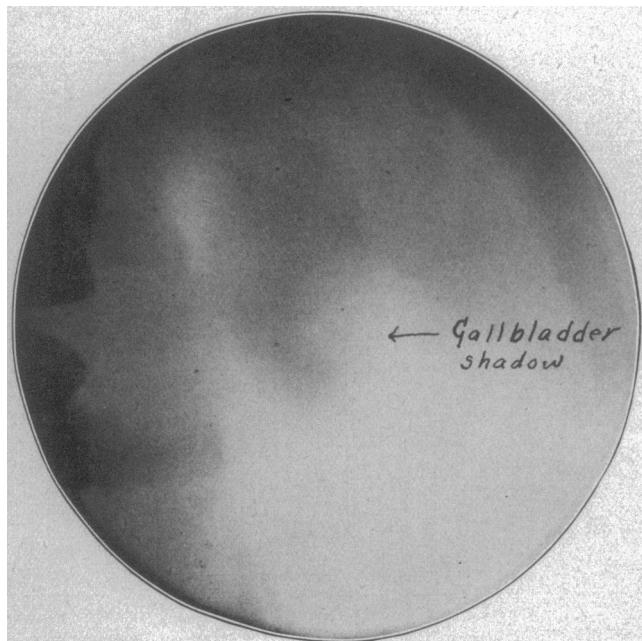


Fig. 3.—Appearance of same gallbladder as in Figure 2, thirty hours after injection: The shadow has become less distinct as the substance has begun to leave the gallbladder.

is instructed to lie on his right side when lying down, but is encouraged to walk around or sit up one or two hours after the injection.

#### TOXICITY

Increasing the dose above 0.25 gm. per kilogram of body weight was found toxic to an animal. Occasionally a hematuria resulted before death. A dose of 0.35 gm. per kilogram is usually fatal instantaneously.

As yet, only a few patients have been injected. All of these weighed 130 pounds (59 kg.) or more and received a dose of from 5 to 6 gm., which is approximately 0.1 gm. per kilogram. Only one suffered any symptoms. When she had received 4.75 gm., or 0.079 gm. per kilogram, she complained of vertigo and slight nausea. Each of these symptoms disappeared in an hour. Slight variation in pulse and blood pressure are recorded, but no more than what might be explained by emotion and an increase in body fluid. None suffered hematuria or albuminuria.

#### RESULTS

As stated, definite and distinct shadows of the gallbladder are obtained on exposure to the roentgen ray. Up to date, shadows have been obtained on all patients who presumably had a normal gallbladder. It is more difficult to obtain a shadow of a pathologic gallbladder. We believe, however, that this fact will be almost as much aid in diagnosis as a good shadow, since we feel that virtually all normal gallbladders can be made to cast a shadow if proper methods are used. Effort is being made by us to devise methods that will withhold the dye in the biliary system for a longer time, and in a greater concentration.

#### TECHNIC OF IRIDECTOMY DONE UNDER A CONJUNCTIVAL FLAP FOR GLAUCOMA, USING A BROAD KERATOME\*

ROBERT G. REESE, M.D.  
NEW YORK

During the period of ten years preceding Jan. 1, 1923, there have been performed 538 operations for glaucoma in my service at the New York Eye and Ear Infirmary.

As it is impossible to follow up clinic patients successfully, it has been deemed wise to confine this report to 237 operations that I have performed on private patients, whose subsequent histories have been accurately followed for periods varying from four months to fifteen years. These patients have been repeatedly observed, and their fields, blind spots, tension and vision taken at practically every examination. Peters' and Lloyd's binocular campimeters and the tangent plane were used for recording Mariotte's blind spots, Rönne's step, and Seidl's and Bjerrum's scotomas. The tension was determined by digital palpation, and by Schiötz, Gradle-Hardy and McLean tonometers.

One hundred of these cases were tested by Dr. Drake and myself, by digital palpation, and two models of each of the above-mentioned tonometers. It was found that the Schiötz tonometer was more accurate and easier to manipulate. The ages of the patients varied from 5 (not buphthalmos) to 87 years. There were sixty-five congestive and 172 noncongestive glaucomatous eyes operated on, and there was not a single instance of infection at the time of operation, or post-operative infection; moreover, I have never had an infection after an iridectomy done under a conjunctival flap (and I must have performed more than a thousand), as I do all iridectomies (preliminary, optical, etc.) by the method here described.

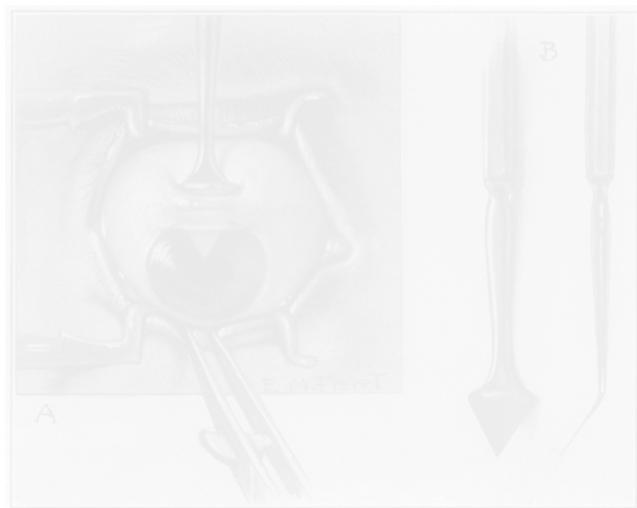


Fig. 1.—A, conjunctiva pushed forward to scleral opening, and entrance of keratome in anterior chamber anterior to plane of iris; B, broad keratome with rounded angles at base, and plane of cutting surface angulated at 21 degrees; blade is shorter and point less acute than usually used.

#### PREPARATION OF THE PATIENT

Every glaucoma patient is admitted to the hospital twenty-four hours before operation. A calomel and soda purge is given, followed by a saline in eight hours. A smear of the conjunctiva is taken as a routine measure.

\* Read before the Section on Ophthalmology at the Seventy-Fourth Annual Session of the American Medical Association, San Francisco, June, 1923.