

# Treatment of Chronic Typhoid Carriers by Cholecystectomy

JULIA L. FREITAG, M.D., M.P.H.

FROM 1945 through 1963, 54 chronic typhoid carriers registered with the New York State Department of Health (exclusive of New York City) underwent cholecystectomy. These 54 carriers, plus 14 others, who were released without cholecystectomy, form the basis of this report. All were fecal carriers.

## Release Requirements

The legal definition of a chronic typhoid carrier in New York State is a person who has not suffered from typhoid fever within 1 year, in whose feces, urine, or other discharges typhoid bacilli are present. Such persons are kept under surveillance by the State and local health departments. During the period of time reviewed, a registered carrier could be released from restrictions by either of the following methods:

1. Removal of the gallbladder, followed by eight successive specimens of feces, eight successive specimens of urine, and three successive specimens of duodenal contents, all of which were negative for *Salmonella typhosa*. An interval of at least 5 days between fecal specimens and 24 hours between urine and duodenal specimens was required.

2. As above, except the gallbladder need not be removed if the blood contained no significant Vi agglutinating antibodies.

Most of the laboratory examinations cited in

---

*Dr. Freitag is assistant director of the office of epidemiology, New York State Department of Health, Albany.*

this report were made in the department's division of laboratories and research; the remainder were made in approved local laboratories.

## Post-Cholecystectomy Status

The postoperative status of the 54 carriers who underwent cholecystectomy is presented in the table. Forty-nine of the carriers were women and five were men. Eleven, or one-fifth, of the carriers were over 70 years of age at the time of surgery, and the average age for the entire group was 57 years. Of 37 of the 54 carriers who gave a history of typhoid fever, 18 had been known to the State health department. The average time from typhoid fever to cholecystectomy was 22.5 years, with a range of 2 to 60 years; 17 were in excess of 20 years.

Thirty of the carriers were released following cholecystectomy and 18 carriers failed to submit sufficient specimens for the determination of their postoperative status. For four carriers it was judged that cholecystectomy had failed or probably failed to cure their carrier state. Two of the four for whom cholecystectomy had failed were not known to be carriers at the time of surgery and the cholecystectomies were performed for gallbladder disease. The minimum cure rate for cholecystectomy in this series was, therefore, 88.2 percent (30 of 34), excluding the two deaths. Of the 34 carriers whose postoperative status was determined, 26 underwent elective cholecystectomy primarily to cure their carrier state and 24 were cured, a cure rate of 92.3 percent.

Two carriers (3.7 percent) died in the imme-

diate postoperative period. One death occurred in a 56-year-old woman who had a cholecystectomy for chronic cholecystitis and cholelithiasis. At operation a gangrenous gallbladder was found, and she died of a coronary thrombosis 2 days following surgery. The second death occurred in a 76-year-old woman who underwent cholecystectomy to cure her carrier state and died of a pulmonary embolism 11 days postoperatively. These deaths occurred in 1945 and 1946. Thus, though the mortality from elective cholecystectomy in the present surgical era is small, it is still to be reckoned with in evaluating a carrier for cholecystectomy.

### Carriers Released Without Surgery

From 1945 to 1963, 14 carriers were released without prior cholecystectomy. Five of these persons may not have been chronic carriers at the time of their declaration. They were declared carriers between 1918 and 1929, one on the basis of a single positive stool 7 months following typhoid fever and four on the basis of a single positive stool, with no history of recent typhoid-like illness. Three of the four were household contacts of patients with typhoid fever.

Three of these 14 carriers were detected during the investigation of cases in the household, and each had a series of positive stools over periods of 3 to 5 months following detection. Two of the three gave a history of typhoid fever 9 and 25 years previously. Seven to 14 years following declaration, stool, duodenal, and urine specimens of the three carriers were consistently negative, and no significant Vi antibody titer was observed.

The remaining six carriers in this group are particularly interesting. Five of the six were declared carriers when their stools remained positive for *S. typhosa* a year or more following recovery from typhoid fever. Serial stool specimens from two of these carriers indicated that one became free of the organism early in the second year and the other in the fourth year following typhoid fever. The remaining three had a lapse of 6 to 25 years between stool specimens; while the earlier specimens had been positive, the later ones were consistently negative, as were duodenal and urine specimens. The

### Postoperative status of 54 typhoid carriers

Age at surgery	Cured	Not cured	Died	Insufficient specimens	Total
Under 20.....	1	-----	-----	-----	1
20-39.....	1	-----	-----	2	3
40-59.....	16	-----	1	6	23
60 and over....	12	4	1	10	27
Total.....	30	4	2	18	54

sixth carrier of this group, discovered as a result of an investigation of a case, had consistently positive stool specimens over a period of 5 years. During the next 5 years, annual specimens were negative until the fifth year when the specimen was positive. Over the subsequent 7 years, none of 21 stool specimens were positive, and in addition, two Vi agglutination tests were negative as were duodenal and urine specimens.

At least 9 of these 14 carriers were considered to represent "spontaneous cures."

### Laboratory Results

During the years between confirmed typhoid fever or discovery as a carrier and cholecystectomy, the carriers submitted a total of 514 stool specimens, of which 500 (97 percent) were positive for *S. typhosa*. *S. typhosa* was isolated from preoperative duodenal specimens or the gallbladder, or both, in 42 of the 54 carriers who underwent cholecystectomy. The remaining 12 had no reported preoperative or operative culture results. Of 30 carriers who were released following cholecystectomy, 23 had positive gallbladders, 3 had positive preoperative duodenal specimens, and for 3 cultures were not made. The gallbladders of all four carriers for whom treatment failed yielded *S. typhosa*.

Of the 30 carriers who were released following cholecystectomy, some never had positive stool cultures postoperatively, while others required from several weeks to 6 months or more for their stools to clear. The time which elapsed between cholecystectomy and last fecal release specimen ranged from 1 month to 5 years. The elapsed time was less than 2 months for 6 carriers, 2-6 months for 9 carriers, 6-12

months for 7 carriers, and in excess of 1 year for 8 carriers. In general, the conversion from positive to negative stools was rather abrupt once the transition started. A significant period of intermittent excretion of typhoid organisms did not occur.

Two carriers with positive gallbladders at surgery had three successively negative postoperative duodenal specimens while their stool specimens were consistently positive. An additional two carriers had single negative duodenal specimens, while stools were positive. Several explanations for this finding are possible, such as errors in collecting, handling, or identification as duodenal specimens, but, nevertheless, the duodenal specimens were considered acceptable by the examining laboratory.

One carrier with a positive gallbladder at surgery had six successively negative stool specimens during the first 2 postoperative months, while three of six duodenal specimens were positive.

## Discussion

A cure rate of 92.3 percent, excluding the one death, for those carriers undergoing elective cholecystectomy for cure of their carrier state, is higher than in earlier reported series. Senftner and Coughlin (1) cited a cure rate of 59 percent to 77 percent in the same series of carriers, depending on the criteria employed for "cure" and the exclusion or inclusion of postoperative deaths. In 1950, Vogelsang (2) published a review of a number of series of chronic typhoid and paratyphoid B carriers who underwent cholecystectomy, and concluded it was possible to cure 75 percent to 80 percent by surgical management. Possibly, improved operative techniques during the last two decades may have played a role in improving the cure rate (3). The suggestion has been made that prior to the mid-1940's it was not always a routine practice to remove the entire cystic duct and explore (or at least "run") the common duct at the time of cholecystectomy. Such omissions would, of course, afford greater opportunity for foci of infection to be left behind and especially so if any obstruction to the free flow of bile was not removed.

The isolation of *S. typhosa* from 97 percent

of all stool specimens submitted by the carriers over the years prior to cholecystectomy indicates little intermittency of excretion. Since no quantitative estimate of the number of organisms present in individual fecal specimens was attempted by the laboratory, the results indicate only the presence or absence of detectable numbers of organisms. The results suggest, however, that the accepted opinion that typhoid carriers are not infrequently intermittent excretors of *S. typhosa* should be weighed against the possibility that it may be the detection by the laboratory which is intermittent and not the excretion by the carrier (4).

Based primarily on the findings that: (a) gallbladder carriers consistently excrete typhoid bacilli in their stools, (b) if cured, they convert to consistently negative stools, and (c) no carrier would have been released prematurely had examination of duodenal specimens been omitted, the requirements for release have now been modified in New York State. It is now (1964) possible for a carrier to be released without submitting duodenal specimens. The alternate method permits release if 16 successive fecal specimens are found to be negative for *S. typhosa* by the State laboratory. The fecal specimens must be authenticated by the finding of previously ingested lycopodium spores in the specimens, and the 16 specimens must be submitted over a period of at least 9 months following cholecystectomy. Carriers not requiring cholecystectomy for release (insignificant Vi antibody titer) may submit fecal specimens at any time, provided there is at least a 5-day interval between the collection of each specimen.

## Summary

From 1945 through 1963, 54 chronic typhoid carriers registered with the New York State Department of Health underwent cholecystectomy. Of 34 carriers for whom determination of postoperative status was possible, 30 (88 percent) were considered cured. Twenty-six of these 34 carriers underwent cholecystectomy primarily to cure their carrier state, and 24 (92 percent) were cured.

Two of the 54 carriers died postoperatively. One was a 76-year-old woman for whom

cholecystectomy was performed primarily to cure her carrier state. An additional 14 carriers were released without prior cholecystectomy. Nine of these were considered to represent "spontaneous cures."

Of 514 preoperative fecal specimens submitted by the carriers, 500 (97 percent) were positive for *Salmonella typhosa*.

Release of typhoid carriers in New York State no longer requires the submission of duodenal specimens. This modification was based primarily on the findings that: (a) gallbladder carriers consistently excrete typhoid bacilli in their stools, (b) if cured by cholecystectomy, carriers convert to consistently negative stools, and (c) no carrier would have been released

prematurely if examination of duodenal specimens had been omitted.

#### REFERENCES

- (1) Senftner, H. F., and Coughlin, F. E.: Typhoid carriers in New York State, with special reference to gall bladder operations. *Amer J Hyg* 17: 711-723, May 1933.
- (2) Vogelsang, T. M.: Typhoid and paratyphoid B carriers and their treatment. *Universitetet I Bergen Yearbook*. A. S. John Griegs Boktrykkeri, Bergen, Norway, 1950.
- (3) Whipple, A.: The surgical treatment of bile typhoid carriers. *Ann Surg* 90: 631-642 (1924, pt. 2).
- (4) Garbat, A.: Typhoid carriers and typhoid immunity. Monograph No. 16. Rockefeller Institute for Medical Research, New York, 1922.

## Reduction in Calorie Allowances

The ease of modern living and an accompanying decrease in rigorous physical activity for most Americans have led the Food and Nutrition Board of the National Academy of Sciences-National Research Council to lower its recommended daily calorie allowance for adults.

In the recently revised *Recommended Dietary Allowances* (NAS-NRC Publication No. 1146), the calorie requirement of the "reference man" (25 years old, 154 pounds, and moderately active) has been reduced to 2,900 calories daily from the 3,200-calorie diet recommended for the same man in 1958.

Similarly, the diet of the "reference woman" (25 years old, 128 pounds, and moderately active) has been lowered to a suggested 2,100 calories per day from the 1958 recommendation of 2,300 calories.

Recommended daily levels for the nutrients thiamin, niacin, and riboflavin, which are based on calorie requirements, have also been reduced. A decrease in recommended cal-

cium for children aged 1-9 years, women in the second and third trimester of pregnancy, and lactating women is another change in the allowances.

Alcohol is included for the first time in the consideration of nutrients for which specific requirements or effects have not been tabulated. Americans consume an estimated 76 calories of alcohol per capita (including children and nonusers) per day, making this substance an important factor in studies of caloric intake.

Nutrient levels recommended by the Food and Nutrition Board are high enough above average physical requirements so as to cover variations among most Americans today. Although often incorrectly used as inflexible standards rather than guides, the allowances do not necessarily reflect the nutritional needs of any one person or group according to the board, since these can be judged only after careful physical, biochemical, and clinical evaluations.