

CONCLUSION

Artificially created Thebesian canals have been made by inserting free arterial grafts into the lumen of the left ventricle.

Some of these grafts have remained open with one end facing into the ventricular lumen and the other end buried in the wall of the left ventricle.

Polyethylene tubing has been used to help in keeping the grafts patent.

MODIFIED LARYNGEAL SWAB
METHOD FOR THE DETECTION
OF TUBERCLE BACILLI IN
PULMONARY TUBERCULOSIS*

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LARYNGEAL, or sublaryngeal swabs for the detection of tubercle bacilli first came into use in 1905. Blume,¹ in the Low Countries, reported that he had examined microscopically smears of swabs taken from patients with active tuberculosis. In 1931, Grass² reported that cultures of laryngeal swabs are an aid in the diagnosis of tuberculosis. Schramek and Hegedus³ published a detailed description of a laryngeal swab technique for the detection of tubercle bacilli in 1935. The technique which these investigators described, or modifications thereof, have been used in many places in Europe in the past fifteen years.

In 1951, Armstrong and Foster⁵ described a new method of culturing laryngeal swabs. Their method differs from that of earlier investigators in that they inoculate tubes of Dubos-Middlebrook's liquid oleic acid albumen medium with the washings of swabs.

Later in 1951 Armstrong⁶ reported on the results of comparison of cultures of one specimen of gastric contents and cultures of three laryngeal swabs processed in the manner just described. His laryngeal swab material consisted of specimens collected on each of three successive days. He found that in a series of 967 such comparisons, one culture of one laryngeal swab specimen was somewhat superior to one culture of one gastric contents specimen, and that three consecutive laryngeal swab cultures yielded almost twice as many positive findings as one gastric contents culture.

By reason of the great number of out-patients, many tuberculosis clinics and hospitals are unable to apply to all of them the repeated sputum

or gastric contents examinations which are required to permit of classification of all the pulmonary lesions in essentially asymptomatic but x-ray positive persons in terms of present generally accepted standards. (Diagnostic Standards 1950). The laryngeal swab method of collecting and examining specimens for the detection of tubercle bacilli seems to offer a means of determining the bacteriological status of a far greater number of persons than can be done by the usual routine methods. Besides, as pointed out by Armstrong, the swab method is far more acceptable to the patient than is gastric lavage, and the patient, who does not need to be fasting, can be examined at any time of the day.

In an effort to assay the procedure described by Armstrong, specimens for examination for tubercle bacilli were collected by the laryngeal swab method from one hundred patients in hos-

TABLE I.

| STUDY OF 100 HOSPITAL PATIENTS | |
|-------------------------------------------------------------------------------------------------|------|
| Armstrong's Technique: 3 swabs taken at 3 sittings. | |
| 1. Comparison between cultures from swab-washings and cultures from gastric contents or sputum: | |
| Gastric contents (or sputum) +, laryngeal swabs + | : 46 |
| " " " " -, " " | : 18 |
| " " " " +, " " | : 11 |
| " " " " -, " " | : 25 |
| 2. Number of positive swab-cultures for each swab-positive patient: | |
| (a) Gastric contents (or sputum) +, laryngeal swab + | |
| Swab-culture + once | : 13 |
| " " + twice | : 14 |
| " " + all 3 times | : 19 |
| | 46 |
| (b) Gastric contents (or sputum) -, laryngeal swab + | |
| Swab-culture + once | : 14 |
| " " + twice | : 5 |
| " " + all 3 times | : 6 |
| | 25 |

pital. The results obtained from the cultures of these swabs were compared with the results of all the routine examinations of specimens of sputum or of fasting gastric contents collected from these same patients in the two or three months preceding introduction of the laryngeal swab method and the month immediately thereafter. The findings obtained in the course of this study are recorded in Table I. The swab cultures failed to yield evidence of *M. tuberculosis* in 11 instances in which specimens of sputum or fasting gastric contents did so. In 25 instances, however, the swab washings gave evidence of *M. tuberculosis* when the sputum or fasting gastric contents failed to do so.

While the work just described was in progress, we began to suspect that in some instances tubercle bacilli were being lost when the cotton swab was discarded after having its contents

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supposedly expressed inside the culture tube. Considerations of this kind, and the fact that Grass discarded the washings and cultured the swabs while Armstrong discarded the swabs and cultured the washings, led us to attempt to introduce some changes in the latter's technique. We found that the cotton on the laryngeal swab applicators can be replaced by "Gelfoam"* which is made of gelatine and is commonly used to produce hæmostasis. This material dissolves in 3% NaOH and does not interfere with the growth of tubercle bacilli in the oleic acid albumen medium; Gelfoam swabs, dipped in a dilution (10^{-6}) of a ten-day culture of H₃₇R_v, each c.c. of which contains 0.20 mgm. (dry weight) of bacilli, gave positive cultures.

TABLE II.

| STUDY OF 204 OUT-PATIENTS | | | | |
|-----------------------------------------------------------------------------------------|---|----------------|---|-------|
| Modified technique with "Gelfoam": 2 swabs taken on one sitting | | | | |
| 1. Comparison between cultures from dissolved swabs and cultures from gastric contents: | | | | |
| Gastric contents | + | laryngeal swab | + | : 31 |
| " | - | " | - | : 157 |
| " | + | " | - | : 2 |
| " | - | " | + | : 14 |
| 2. Number of positive swab-cultures for each swab-positive patient: | | | | |
| (a) Gastric contents | + | laryngeal swab | + | |
| Swab-culture | + | once | | 9 |
| " | + | twice | | 22 |
| | | | | 31 |
| (b) Gastric contents | - | laryngeal swab | + | |
| Swab-culture | + | once | | 12 |
| " | + | both times | | 2 |
| | | | | 14 |

The laryngeal swab method which we have evolved as a result of the foregoing is briefly as follows:

The swabs are taken with Gelfoam, measuring approximately 1 x 3 cm., rolled around the applicator and fixed with silk thread. Pieces of Gelfoam of this size dissolve in 2 c.c. of 3% NaOH in twenty to twenty-five minutes at 38° C. The applicator is then removed. Thereafter the fluid is neutralized with a few drops of 50% hydrochloric acid. Phenolphthalein is used as indicator. 25 c.c. of oleic acid albumen medium⁷ is then added to the neutralized fluid and the tube, the same one in which the applicator with its Gelfoam swab was originally introduced, is plugged, covered with paper to reduce evaporation, and incubated for six, seven or eight weeks. Table II portrays results obtained by means of two laryngeal Gelfoam swabs and one specimen of fasting gastric contents. Swabs and fasting gastric contents were collected within a few minutes of each other on one and the same morn-

*"Gelfoam" The Upjohn Company, Kalamazoo, Michigan, U.S.A.

ing. Out-patients, 204 in number, were the source of the specimens for this study.

Swab cultures obtained from this group of patients failed to yield signs of *M. tuberculosis* in only two instances in which the gastric contents cultures proved to be positive. They yielded evidence of *M. tuberculosis*, however, in 14 cases in which the gastric contents cultures failed to do so. These findings seem clearly to indicate that two laryngeal Gelfoam swab cultures are superior to one fasting gastric contents culture insofar as the detection of tubercle bacilli in out-patients presenting x-ray signs suggestive of pulmonary tuberculosis is concerned.

A comparison of the number of positive swabs for each swab-positive patient in both tables reveals that patients with positive cultures from gastric lavage or sputum frequently have both, or all three laryngeal swab cultures positive. On the contrary, when the cultures of gastric contents or sputum are negative, at least three swabs should be taken to confirm the result.

Having demonstrated that the new laryngeal swab method described herein affords a ready and seemingly superior means for detecting tubercle bacilli in out-patients, we have recently undertaken to use this procedure in all persons with asymptomatic minimal pulmonary disease—presumably tuberculosis—who report to our clinic for advice. Our present routine in this connection is to take two laryngeal swabs the first time that each person in the category just described reports to our clinic, and to take two more swabs one week later on the occasion of his second visit. The results of this investigation will be reported later.

CONCLUSION

Presently available findings seem clearly to indicate that the modified laryngeal swab method is going to make it possible to assess the bacteriological status of pulmonary lesions in out-patients under our supervision more accurately than has been the case heretofore.

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The discoveries of the past have given to the present generation an impressive scientific background and the tools to carry on, but at the same time they have revealed the boundaries of large areas of terra incognita. Its exploration is the task ahead, to success in which we may look forward with confidence. We know that nature does not willingly yield its secrets, but we also know that she has to contend with man's unquenchable thirst for knowledge.—M. L. Tainter: *Int. Rec. Med. & Gen. Practice Clin.*, 166: 227, 1953.