EXAMINATION OF GASTRIC CONTENTS FOR TUBERCLE BACILLI IN ADULTS

BY

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As far back as 1898 Meunier showed that tuberculous children often swallowed their sputum. By washing out the fasting stomach he obtained mucoid material looking like sputum in which tubercle bacilli could be demonstrated by the method of direct smears. This work attracted no attention until Armand-Delille and Vibert reintroduced Meunier's technique in 1927. Since then numerous workers have published results obtained by this method and its modifications, thus confirming the value of the method in the diagnosis of tuberculous pulmonary lesions (both in children and adults) when no sputum is available for examination. Both culture and animal inoculation of the gastric contents have been carried out, examination by direct smears having proved unreliable.

In a recent paper Belgorod and Schain (1939) have shown that the ordinary methods of sterilization of the stomach tube and other utensils may lead to erroneous positive results when the direct-smear method is used for examination of the gastric contents, because fine particles containing tubercle bacilli may adhere to the interior of the tube or glass vessels and become dislodged when the latter are used for another patient. The possible confusion with acid-fast saprophytes is another strong argument against the use of the direct-smear method in connexion with the gastric contents unless animal inoculation or culture is practised in addition.

The examination of the gastric contents in children is now established as a routine method of investigation in many Continental clinics; in this country, apart from the research work of Collis and Brockington (1933), the method is used to our knowledge in at least two institutions—in the Highwood Hospital for Children (L.C.C.) and in connexion with the Birmingham Tuberculosis Scheme. Levin's monograph (1934) contains in addition to his own valuable investigations a detailed review of the literature up to that time. Saenz and Costil (1936) in their monograph on the bacteriological diagnosis of tuberculosis give additional data.

The use of the method in adults has attracted less attention. Armand-Delille, Lestocquoy, and Vibert (1930) were the first to suggest its employment in adults. The following authors have since then published their results: Elizaguirre and Uralde (1931), Clausen (1931), Ulmar and Ornstein (1933), Gad (1934), Lester (1934), Nasta, Blechmann, and Bacanu (1934), Cervino and Radroguez (1934), Sayé (1935), Menzel and Schramek (1935), Stiehm (1937), Gullbring and Levin (1937), and Stadnichenko and Cohen (1937).

Gullbring and Levin (1937) review the literature on the subject and describe their own results in 348 patients. They carried out direct examination, culture on Hohn's medium after treatment with 10 per cent. sulphuric acid, and animal inoculation. They found the last method much superior to that of culture, though a few positive results were obtained by culture alone. A single negative gastric examination was not proof of absence of bacilli; when the gastric lavage was

repeated once or twice the number of positive results was increased. They therefore advise that the stomach be washed out on three successive days, but to save cost the washings should be mixed together before examining. The 348 patients investigated by them either did not produce any sputum or their sputum showed no bacilli on direct examination. (The latter group was included in the belief that expectorated material does not always come from the bronchi.) In 192 patients (55 per cent.) tubercle bacilli were found in the gastric contents. With fresh infiltrations the probability of finding tubercle bacilli increased proportionately to the extent of the radiological shadow. Ninety-four per cent. of patients showing cavities not associated with sputum or associated with sputum in which tubercle bacilli had not been demonstrated by the direct method gave a positive result in the stomach contents. Tubercle bacilli were found in no fewer than thirty-four out of 106 patients (32 per cent.) showing so-called benign fibrosis of the apical region (generally considered as "closed phthisis") or healed lesions. Finally, bacilli were demonstrated in seven out of twenty-five patients (28 per cent.) with pleural effusion; gastric lavage thus appeared to be an excellent method of detecting parenchymatous involvement in those cases where the fluid obscures the lung lesion.

Stadnichenko and Cohen's work (1937) on 600 patients in a sanatorium showed that in 46 per cent. of those with clinical tuberculosis "who had never shown a positive sputum" bacilli were demonstrated when the gastric sediment was injected untreated into guinea-pigs; 39 per cent. of these were positive on smear of the gastric sediment.

No results of the use of this method in adults have been published in this country. The method was first introduced in 1936 by one of us (G. G. K.) and subsequently also used by the other (A. G. H.) at the County Sanatorium, Clare Hall, Middlesex. This paper is based on the first 114 patients so investigated.

Technique

The patient is given no food or drink after 10 p.m. the previous day. The contents of the stomach are removed as soon as possible after waking in the morning; this time is chosen because the material is not then mixed with food and because during the night the gastric peristaltic movements are much diminished and the more viscid contents tend to collect in the organ. A fine stomach tube is passed. The stomach contents can be aspirated at once; as, however, the material obtained in this way is generally not more than a few cubic centimetres, the method adopted by us was to inject through the tube by means of a funnel or container and rubber tubing about 6 to 8 oz. of warmed boiled sterile water or saline. The gastric contents are mixed by injecting air by means of a 20 c.cm. syringe attached to the stomach tube. The syringe should be sterile, and in detaching the container or funnel, and in attaching the syringe, care must be taken not to contaminate the distal opening of the stomach tube with the fingers. The stomach contents are then aspirated by siphonage or by the syringe into a sterile bottle. Particular care should be taken to obtain the more viscid residual contents.

The bottle and its contents were sent to Dr. Herbert Rogers at the North Middlesex County Hospital, to whom we are indebted for the following notes of the subsequent examination of the material.

The lavage is allowed to stand overnight, and the supernatant fluid removed on the following morning. Five c.cm. of the deposit is placed in a sterile test-tube and about 20 c.cm. of 4 per cent. NaOH added. This is incubated for twenty minutes (or until it appears to be homogeneous) and shaken frequently. The specimen is then centrifuged for ten minutes and the supernatant fluid decanted. The deposit is

now neutralized, using 8 per cent. HCl and litmus paper as an indicator. Several loopfuls are inoculated on to Loewenstein-Jensen medium and incubated at 37° C. If the culture remains sterile for one month a negative report is returned. About 15 to 20 c.cm. of the first sediment which has accumulated overnight from the "gastric lavage" is sent to Dr. Benians at the Prince of Wales's Hospital, Tottenham, for guinea-pig inoculation.

Results

The material investigated comprises 114 patients (fifty-five male, fifty-nine female). Table I indicates the number of lavages carried out on each patient.

TABLE I

Times Lavaged	Patients	No. of Lavages
Once	82	82
Twice	19	38
Thrice	9	27
Four times	4	16
	114	163

In Table II are summarized the results obtained by culture and by inoculation.

TABLE II

	Guinea-pig Inoculation	Culture	No.
Positives (57)	Positive	Positive	15
	"	Negative	28
	Negative	Positive	10
	Guinea-pig died *	"	1
	Positive	Contaminated	3
Possible positives (12)	Negative	Contaminated	7
	Guinea-pig died *	Negative	4
	" "	Contaminated	1

* Death soon after inoculation from intercurrent infection.

The number of positive results is therefore 57 in 163, or 35 per cent. (minimum), to 69 in 163, or 42 per cent. (possible maximum).

Comment.—The results appear to confirm the conclusion of Gullbring and Levin that animal inoculation is more sensitive than culture, but that positive results are often obtained by culture alone. It is clear that both methods should be employed.

Analysis of Results in Relation to Diagnosis

In fifty-five of the patients there was no sputum or the sputum on admission proved negative by direct and cultural methods. (Before admission the sputum had been negative, or there was no record of its having been examined; and in two cases it had been reported as positive, but on admission to the sanatorium the patients were found to have no sputum or it was scanty and negative by direct and cultural methods.) Of these fifty-five patients gastric lavage proved positive in seventeen and negative in thirty-eight.

POSITIVE GROUP (SEVENTEEN PATIENTS)

(a) *Eleven Patients had No Sputum.*—In these the clinical diagnosis proved to be pleural effusion (two patients), chronic pulmonary tuberculosis (six), primary tuberculous infection (one), chronic miliary tuberculosis (one), advanced bilateral pulmonary tuberculosis (one).

(b) *Six Patients had Some Expectoration.*—The following is a brief résumé of the antecedent bacteriological examinations and the clinical diagnosis:

Patient 1: direct negative once (saliva only), positive before admission; pulmonary tuberculosis. Patient 2: positive before admission, three direct negatives, then no sputum; pulmonary tuberculosis. Patient 3: three direct negatives, then scanty sputum; pulmonary tuberculosis with artificial pneumothorax. Patient 4: three direct negatives, negative culture; pulmonary tuberculosis and pleural effusion. Patient 5: five direct negatives; pulmonary tuberculosis and pleural effusion. Patient 6: three direct negatives, negative culture; pleural effusion.

NEGATIVE GROUP (THIRTY-EIGHT PATIENTS)

In one patient the second gastric lavage proved positive, but the first time the guinea-pig had died. In a second patient tubercle bacilli were found in expectorated material one week later (a case of advanced pulmonary tuberculosis). In a third patient the gastric lavage proved positive three months later (patient first admitted with an effusion). The diagnosis in these thirty-eight patients was as follows.

(a) *Nineteen were proved subsequently not to be suffering from pulmonary tuberculosis.* The diagnoses were: bronchiectasis (one), lymphadenoma (one), diabetes and pulmonary neoplasm (one), resolving pneumonia (one), tuberculosis contact (one), healed tuberculosis of the spine (one), erythema nodosum (one), bilateral spontaneous pneumothorax (one), pleurisy or pleural effusion (eleven).

(b) *In the remaining nineteen patients the subsequent clinical diagnosis was chronic pulmonary tuberculosis.* The following are brief notes of these patients. (A.P. = artificial pneumothorax. S.R. = sedimentation rate: Westergren, 1 hour. I.P. = in-patient. L. = left side. R. = right side. G.L. = gastric lavage.)

1. Male, aged 19. Admitted with R.A.P. induced 6 months before. Good collapse; S.R. = 2; apyrexial. Developed effusion, otherwise uneventful progress until discharge after 4½ months.

2. Female, aged 20. Admitted with L.A.P. induced 6 months before. Adhesions, but no obvious cavity. Slight pyrexia (no fluid); S.R. = 6. Adhesions cut, uneventful progress; discharged after 7 months.

3. Male, aged 15. Admitted with L.A.P. induced 5 months before. Apyrexial; S.R. = 6. Diabetes mellitus. Good collapse, no fluid; uneventful progress until discharge 6 months later.

4. Male, aged 19. Admitted with extensive bilateral mottling, ? small cavities. Pyrexial; S.R. = 93. Bed rest for several months, sanocrysin. L.A.P. induced 6 months after admission, when R. lung almost cleared and cavity obvious on L. I.P. for 15 months. Six months after discharge returned with fresh cavity at R. apex.

5. Male, aged 25. Admitted with calcified foci and linear shadows in R. upper zone, and nodular mottling in L. upper zone. S.R. = 2; slight pyrexia. Bed rest and sanocrysin. I.P. 9 months. On discharge, slight linear shadows in both upper zones.

6. Male, aged 36. Admitted with mottling and linear shadows both apical regions; ? cavitation L. apex. Apyrexial; S.R. = 6. Routine sanatorium regime. I.P. 3 months. On discharge, very little radiological change.

7. Male, aged 24. Discovered as contact. Admitted with mottling and definite small cavity in L. upper zone. No pyrexia; S.R. = 11. L.A.P. G.L. negative. Adhesions cut. Scanty negative sputum (3 examinations); G.L. negative. Then good collapse. I.P. 6 months. Discharged with good L.A.P., S.R. = 2.

8. Male, aged 17. Admitted with L.A.P. (adhesions and small cavity visible), and scattered mottling all zones (R.). No pyrexia; S.R. = 5. Adhesion-section; good collapse; sanocrysin. On admission, G.L. negative. Five months later G.L. negative. I.P. 10 months. On discharge, good L.A.P., S.R. = 2.

9. Female, aged 21. Admitted with extensive bilateral disease, ? small cavities. Pyrexial; S.R. = 36. Tuberculous

laryngitis. One week later coughed up some sputum which was positive. Died 5 months later.

10. Female, aged 15. Admitted with mottling L. upper zone. A contact. Afebrile; S.R. = 10. Bed rest. Discharged 6 months later with shadows harder; S.R. = 4.

11. Female, aged 16. Admitted with linear shadows R. middle zone. Apyrexial; S.R. = 4. Had had R.A.P. abandoned after 6 refills. Routine sanatorium treatment. On discharge 6 months later, shadows unchanged; S.R. = 2.

12. Male, aged 20. Admitted with mottling and definite cavitation L. upper zone. Slight pyrexia, S.R. = 2. L.A.P. and adhesion-section; good collapse. Uneventful progress. I.P. 3 months. Discharged himself; S.R. = 2.

13. Male, aged 32. Admitted with R. pleural effusion and linear shadows upper half both lungs, heart and mediastinum to R. No pyrexia; S.R. = 23. Bed rest and routine regime. I.P. 9 months. On discharge, shadows much less marked, pleural thickening R. base, S.R. = 1.

14. Male, aged 22. Admitted with R. pleural effusion and mottling in R. upper and middle zones. No pyrexia; S.R. = 17. Bed rest; I.P. 6 months. On discharge, effusion gone, linear shadows R. apex, S.R. = 2.

15. Male, aged 19. Haemoptyses. Admitted with mottling and cavitation L. upper zone. Afebrile; S.R. = 2. L.A.P. Adhesions, not cut, but cavity closed. I.P. 5 months. On discharge, L.A.P. with apical adhesions, S.R. = 1.

16. Male, aged 15. Admitted with L. pleural effusion and mottling L. upper zone. Slight pyrexia; S.R. = 8. Bed rest. I.P. 5 months. On discharge, linear shadows only L. apex, S.R. = 4.

17. Male, aged 26. Admitted with linear shadows both upper zones. Had already had 3 months' bed rest and sanocrysin. Apyrexial; S.R. = 2. Routine regime and sanocrysin. I.P. 6 months. On discharge, linear shadows only, S.R. = 2.

18. Female, aged 28. Admitted 4 months after total thoracoplasty. Uneventful course; I.P. 3 months.

19. Female, aged 34. Admitted with mottling and linear shadows R. upper zone, and linear shadows extreme L. apex. Slight pyrexia; S.R. = 25. Bed rest. I.P. 8 months. On discharge, hard shadows R. apex, S.R. = 8.

Comment.—Clinically there was no definite evidence of activity in Cases 1, 2, 3, 6, 11, 17, or 18, so that a negative gastric lavage might well have been expected. In Cases 5, 8, 10, 13, 14, and 16 the clinical evidence suggested activity, and in some of these patients a positive gastric lavage might have been expected. In Cases 4, 7, 9, 12, 15, and 19 there was definite radiological evidence of cavitation or definite clinical evidence of activity, and a positive gastric lavage ought to have been obtained. The conclusion, already formulated by Gullbring and Levin (see above), is therefore justified, that while in a large proportion of patients with active pulmonary tuberculosis, even when limited in extent, a positive gastric lavage is obtained in the absence of sputum, in an appreciable proportion of such patients the gastric lavage is negative. A simple negative gastric lavage cannot therefore be accepted as evidence of the absence of active disease.

Analysis of Results in Relation to Treatment

This group comprises patients who on admission to sanatorium were positive by direct smear, on culture, or by gastric lavage, and who subsequently were sputumless (thirty-five patients) or in whose sputum no bacilli could be found by direct or cultural methods (twenty-five patients). The results are shown in Table III, where is also indicated the relation of the results to cavitation seen radiologically.

Comment.—Among forty-eight patients with no radiological evidence of obvious cavitation the gastric contents were positive in eighteen (37 per cent.). Among twelve

TABLE III.—*Patients After Treatment (Positive on Admission)*

No Sputum		Sputum Negative (Direct or Culture)	
(a) G.L. +	15	(c) G.L. +	8
(b) G.L. -	20	(d) G.L. -	17
Groups a + c (= G.L. +)		Obvious cavity	 5
" " "		No obvious cavity	 18
Groups b + d (= G.L. -)		Obvious cavity	 7
" " "		No obvious cavity	 30

patients with radiological evidence of obvious cavitation the gastric contents were negative in seven (58 per cent.). Examination of the gastric contents thus appears of much value in treatment in the absence of radiological evidence of cavitation. Negative gastric contents may, however, be found with radiological evidence of obvious cavitation. As it has already been shown that a single negative gastric lavage does not exclude active disease the possible deduction—that the diagnosis of cavitation on radiological appearances is unreliable—is not justified.

Gastric lavage of some of these patients was carried out two or more times during their stay at the sanatorium—twice in nineteen, three times in nine, and four times in four: brief notes of these last two groups follow, to indicate the connexion of the findings with certain features in the clinical course.

GASTRIC LAVAGE THRICE

1. Female, aged 27. Admitted with multiple cavities R. upper zone, mottling R. lower and mid-zones, and nodular shadows all zones L. Afebrile; S.R. = 42; sputum +. Eight months later, S.R. = 11, 3 direct negatives, 1 negative culture, sputum scanty. Considerable x-ray clearing 3 months later; G.L. +. Allowed up. Two months later, G.L. +. One month later, further improvement, G.L. +. One month later, S.R. = 13. Discharged. Six months later, S.R. = 26, new area of mottling R. mid-zone.

2. Female, aged 34. Admitted with mottling R. upper and mid-zones, cavity with fluid level in upper zone, slight mottling L. mid-zone. Pyrexial; S.R. = 32; sputum +; tuberculous laryngitis. R.A.P., adhesion-section, sanocrysin. Four months later, cavity still visible, L. side clear, S.R. = 23, sputum +. One month later, R. phrenic evulsion, laryngitis healed, 2 direct negative sputa, one positive culture, then sputum disappeared. One month later, no obvious cavity; allowed up. Two months later, G.L. negative. Two months later, G.L. negative. Two months later, G.L. negative.

3. Male, aged 18. Admitted with mottling R. lower zone, and mottling all zones L. with a cavity at L. apex. Afebrile; S.R. = 35; no sputum; G.L. +. Bed rest. Four months after admission, L.A.P. Sanocrysin. Two months later, G.L. +. Adhesion-section. Three months later, good L.A.P., R. lung practically clear, S.R. normal, G.L. negative. One month later, A.P. obliterating, L. phrenic crush, gomenol. Five months later, still in sanatorium, no symptoms, S.R. = 2.

4. Female, aged 26. Admitted with mottling R. upper third, afebrile, S.R. = 11, sputum +. Rest; sanocrysin. Four months later, sputum disappeared. One month later, G.L. negative. One month later, scanty sputum, +. X-ray, cavity L. apex, fibrosis R. One month later, L.A.P. Culture of sputum +. Then 3 negative sputa. G.L. +. No obvious cavity. Allowed up. Three months later, scanty sputum, 3 negatives, G.L. negative. Three and five months later as O.P., no cavity.

5. Female, aged 37. Admitted with widespread mottling all zones, small cavity R. mid-zone. Febrile; sputum +. Rest and sanocrysin. Four months later, much improvement. Obvious cavity R. mid-zone. R.A.P. unsuccessful. Three months later, no sputum, G.L. +. Two months later, G.L. +. X-ray, fibrosis R. upper zone, mottling L. upper zone. One month later, G.L. +. Allowed up. Two months later, sputum +, cavitation both upper zones. One month later,

L.A.P. and adhesion-section, good collapse. Four months later, sputum still +, S.R. = 54, waiting for surgical collapse.

6. Female, aged 34. Admitted with mottling and linear shadows R. upper zone, linear shadows extreme L. apex. Slight pyrexia; 3 negative sputa; G.L. negative. Bed rest. Three months later, shadows harder. One month later, G.L. negative. One month later, shadows harder, allowed up. Two months later, G.L. negative. One month later discharged, hard shadows R. apex.

7. Female, aged 26. Admitted with mottling all zones R., cavity R. upper zone, mottling all zones L. Sputum + before admission. Three negatives on admission, then no sputum. Sanocrysin. Three months after admission, G.L. +. Two months later, G.L. +, still cavity R. apex. R.A.P. started, but abandoned. Three months later sputum +. Two months later, R. extrapleural A.P.; scanty sputum, 2 negatives. Two months later, cavity smaller. One month later, discharged well, S.R. = 2.

8. Female, aged 19. Admitted with bilateral widespread fine mottling and linear shadows, no sputum, S.R. = 50. Two direct negatives, then positive culture. Rest. Sputum disappeared. Eight months later, G.L. +. Allowed up. Three months later, G.L. +. Four months later, G.L. +. Four months later, discharged well.

9. Female, aged 23. Admitted with mottling and probable cavity L. upper and mid-zones. Febrile, S.R. = 13; no sputum. G.L. +. L.A.P., adhesion-section. No sputum. One month later, G.L. negative. Good L.A.P., S.R. normal, allowed up. Three months later, G.L. negative. Two months later, discharged well, good L.A.P., S.R. = 16.

GASTRIC LAVAGE FOUR TIMES

10. Female, aged 28. Admitted with mottling both hilar regions. Febrile; S.R. = 45, no sputum. Two months later, G.L. +. Sanocrysin, bed rest. One month later, L. phrenic evulsion. One month later, G.L. +. One month later, G.L. negative, S.R. 9. Allowed up. Two months later, G.L. negative. Three months later, discharged, S.R. = 11, fibrosis L. hilar region.

11. Female, aged 27. Admitted with mottling and fibrosis all zones R., slight mottling all zones L. Afebrile, S.R. = 12, sputum + before admission. Sputum scanty and negative on admission. Rest, sanocrysin. Four negative sputa, negative culture. Four months later, negative culture. Gradually allowed up, shadows harder, no sputum. Two months later, G.L. +. Two months later, G.L. +. X-ray, mottling R. lower zone. R. phrenic evulsion. Two months later, G.L. negative. X-ray picture much improved following phrenic evulsion, but R.A.P. induced. One month later, G.L. negative. One month later, good A.P., S.R. = normal, no symptoms, discharged.

12. Male, aged 16. Admitted with mottling L. mid-zone. Sputum + before admission. Slight pyrexia, no sputum on admission. G.L. negative (culture negative, guinea-pig died). Six months later, improved after bed rest, but G.L. +. Allowed up. Two months later, G.L. negative. Followed shortly by acute illness, ? tuberculous bronchopneumonia, ? epituberculosis. L.A.P. unsuccessful. One month later, L. phrenic crush. One month later, scanty sputum, +. Further bed rest. Four months later, G.L. +. Six months later, G.L. negative, discharged well.

13. Female, aged 20. Admitted with mottling and cavitation R. upper third, mottling L. middle third. Afebrile, S.R. = 59, scanty sputum, +. Two months later, 2 negative sputa, then no sputum. Two months later, G.L. +. X-ray, mottling on R. more marked, cavity obvious, some clearing on L. One month later, R.A.P., adhesion-section, fairly good collapse, no sputum. One month later, G.L. negative, still occasional pyrexia, S.R. = 12, some adhesions still present. Three months later, G.L. +. Two months later, G.L. +. One month later, discharged, S.R. = 11, no symptoms. Five months later, readmitted for adhesion-section, good collapse. One month later, G.L. negative.

Comment.—Although necessarily very brief, the above clinical notes illustrate the value of examination of the

gastric contents in two respects. It was almost of decisive importance in indicating the need for further collapse measures (Cases 3, 9, 10, 11, 12, and 13), and it was of assistance in establishing quiescence in the same patients later and also in Cases 2, 4, and 6. Case 1 was discharged apparently quiescent except for the fact that the gastric contents remained positive: this patient returned six months later with a fresh spread. No. 8 also was discharged apparently quiescent but with the gastric contents positive—six months after discharge she was still well. In both these patients the lesions were then apparently controlled, but in each there must have been a small chronic cavity discharging tubercle bacilli—a potential source of spread of disease, already demonstrated in Case 1.

Conclusions

Examination of the gastric contents for tubercle bacilli in patients who have no sputum, or in whose scanty expectoration no tubercle bacilli can be found by other methods, is of definite value both in the diagnosis and in the treatment of pulmonary tuberculosis. In connexion with treatment the method is of value in deciding on initial or further collapse measures and in establishing that a lesion is quiescent.

Examination of the gastric contents for tubercle bacilli by staining direct smears is unreliable. Animal inoculation is more sensitive than cultural methods, but positive results are often obtained when animal inoculation proves negative; both methods should therefore be used as a routine.

The negative result of a single gastric lavage is not reliable evidence of absence of active pulmonary tuberculosis.

In the present series, in no single case were tubercle bacilli found in the gastric contents when all other clinical evidence pointed against the diagnosis of active pulmonary tuberculosis.

The appreciable number of contaminated cultures and prematurely dead guinea-pigs in this series suggests that further improvements are to be sought either in the collection of the gastric contents and/or in the technique of the bacteriological examination.

There is little doubt that the universal application of the methods of culturing the sputum and examining the gastric contents would greatly alter current views as to the relative incidence of "open" and "closed" pulmonary tuberculosis.

Summary

The results of investigating the gastric contents of 114 sanatorium patients for tubercle bacilli are analysed. The value of the method in both the diagnosis and the treatment of pulmonary tuberculosis is shown. The limitations of the method are indicated.

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REFERENCES

- Armand-Delille, P. F., and Vibert, J. (1927). *Presse méd.*, **35**, 402.
- Lestocquoy, Ch., and Vibert, J. (1930). *Bull. Acad. Méd.*, Paris, **104**, 732.
- Belgorod, S. H., and Schain, P. (1939). *Quart. Bull. Seaview Hosp.*, **4**, 182.
- Cervino, Ramon Garcia, and Radroquez, E. Ramos (1934). *Rev. españ. Tuberc.*, **5**, 437.
- Clausen, V. (1931). *Acto tuberc. scand.*, **5**, 379.
- Collis, W. R. F., and Brockington, C. F. (1933). *Lancet*, **1**, 127.
- Elizaguirre, E., and Uralde, F. L. (1931). *Rev. españ. Tuberc.*, **2**, 327.
- Gad, U. (1934). *Nord. med. Tidskr.*, **8**, 1248.
- Gullbring, A., and Levin, N. (1937). *Acta med. scand.*, **93**, 168.

- Lester, V. (1934). *Amer. J. Dis. Child.*, **47**, 322.
 Levin, N. (1934). *Acta Soc. Med. Suecanae*, **60**, 1.
 Menzel, K., and Schramek, J. (1935). *Beitr. klin. Tuberk.*, **86**, 371.
 Meunier, H. (1898). *Presse méd.*, **2**, 81.
 Nasta, M., Blechmann, M., and Bacanu, C. (1934). *Ibid.*, **42**, 1961.
 Saenz, A., and Costil, L. (1936). *Diagnostic Bactériologique de la Tuberculose*, Paris.
 Sayé, L. (1935). *Rev. Tuberc.*, Paris, **1** (Series V), 441.
 Stadnichenko, A., and Cohen, S. J. (1937). *Trans. Amer. nat. Tuberc. Ass.*, **33**, 235.
 Stiehm, R. H. (1937). *Amer. J. med. Sci.*, **194**, 340.
 Ulmar, D., and Ornstein, G. G. (1933). *J. Amer. med. Ass.*, **101**, 835.

LONG DELAYED SECONDARY HAEMORRHAGE FOLLOWING APPEN- DICECTOMY

BY

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The death rate following and directly attributable to the operation for the removal of a chronically infected appendix is negligible, and there seems to be no reason why it should be anything else. That accidents and misfortunes must from time to time occur is obvious, and as the case here reported is a dramatic example of both, and at the same time appears from a review of the literature to be unique, I feel it is worth recording.

Case Report

A man aged 22 was admitted to a hospital in London on December 18, 1936, with a diagnosis of chronic appendicitis. Through a minute incision a chronically inflamed appendix was successfully removed, and the patient was discharged, apparently cured, on December 28.

On January 16, 1937, nineteen days later, he felt the desire to defaecate, and on doing so passed a considerable quantity of bright red blood, and felt very faint. He was put to bed and seen by his doctor, who ordered rest and quiet for two or three days. No further bowel action occurred until the 20th—that is, twenty-three days after the operation—when he again felt the desire to defaecate, and on doing so passed such a large quantity of blood that he became almost pulseless, and was admitted to the Erith Hospital shortly after. I saw him an hour later, when he was very pale, with a thready pulse of 140 and air hunger. His case presented, in fact, the classical appearance of a grave internal haemorrhage. There was no abdominal pain, and the abdomen moved freely on respiration. Some tenderness was present on deep pressure only, over the sigmoid colon, but no muscle guarding or rigidity. Peristalsis was audible in each quadrant of the abdomen, and there was no suggestion of free fluid in the general peritoneal cavity. A rectal examination was negative, except for the presence of bright blood on the examining finger-stall. I examined him with a sigmoidoscope, but found no cause for bleeding in the rectum or colon, and, further, the blood appeared to be coming from a point above the full length of the sigmoidoscope. The patient was accordingly given large doses of morphine and haemoplastic serum, and preparations were made for a blood transfusion. By daily small doses of morphine, limiting fluids by mouth to bare necessity, and feeding only with concentrated meat extracts in small quantities, he was kept comfortable and in a good condition for eight days without a bowel action. I had at this time made a diagnosis of a pedunculated adenoma somewhere in the colon, and was hoping that his condition would recover sufficiently for a barium enema to be given with a view to localizing the site of haemorrhage.

On January 28, however, thirty-one days after the operation, he suddenly asked for the bed-pan and had another severe haemorrhage, which nearly killed him. A blood transfusion was at once started, and I explored his abdomen through a long right paramedian incision just under one hour from the time of the haemorrhage. Rapid examination of the whole length of the colon showed it to be boggy and full of blood, and no tumour could be felt in the bowel wall. There were a number of recent adhesions round the appendix stump, which appeared to be in a state of more or less active inflammation. The caecum at the site of the stump was very oedematous and inflamed, and contained a mass within the caecal wall. This was opened up without difficulty with the exploring finger, and was found to be an abscess cavity, in the wall of which was a spurting artery of medium size. This was at once ligatured, the abscess cavity swabbed out with half-strength eusol, its opening into the caecum enlarged to ensure adequate drainage into the bowel lumen, and the caecal wall closed by two rows of Lembert sutures. The abdomen was closed without drainage in the usual way.

The patient made an uninterrupted recovery, was discharged three weeks later, and has had no further trouble. He wrote in April saying that he has recently been medically examined and found to be fit and well.

Survey of the Literature

A review of the literature and of the disasters which can overtake a patient following the removal of a chronically inflamed appendix does not reveal such a case so far as I am aware. Both reactionary and secondary haemorrhage after appendicectomy are, however, well described.

Hessert (1906) reports three cases that occurred well within twenty-four hours of operation, and describes in his technique a method of closure of the appendix stump that does not include passing a ligature round the stump, which was, however, invaginated. All three of his cases were associated with massive haemorrhage into the bowel and not apparently into the peritoneal cavity, and it would be safe to assume that the bleeding started from a crushed but unligatured appendix stump and not from the mesentery of the appendix. One of these cases was fatal. Pâtel and Murard (1912) report two fatal cases of haemorrhage from main iliac vessels, but both were classical examples of defective drainage of large abscesses placed in relation to big blood vessels. Auvray (1932) describes an unusual fatal secondary haemorrhage occurring on the eleventh day from the ileo-colic vein, but in this case there were both a localized abscess and general peritonitis.

Fiolle and Figarella (1934) describe two cases in which haemorrhage has occurred along the line of the drainage tube where appendicectomy had been performed during the acute stage. These authors review the literature and consider the possible explanation of these cases. In their opinion the following factors must be taken into consideration: (1) The employment of too strong antiseptics in the cauterization of the stump or in washing out the abscess cavity. (2) The continued spread of infection after operation. (3) Operative trauma in cases where a difficult retrocaecal appendix has been encountered.

That drainage tubes can also play a part is shown by the case of Caraven and Basset, in which the tube was found at necropsy to be lying over an erosion into a main vessel.

Commentary

Reverting to my own case, very few of the foregoing factors can be said to have applied. In the first place, the