aspect of the oesophagus. Having removed the foreign body, I closed the oesophageal wound and allowed the left lobe of the thyroid to fall back, placing a small drainage tube down to the oesophageal incision, and otherwise closed the skin wound. A temporary oesophageal fistula supervened, but healed within a fortnight; otherwise after-progress was uneventful.

The failure to remove the foreign body in this case by endoscopic methods was entirely due to lack of the necessary implements. External oesophagostomy in the face of modern appliances must now be regarded as unnecessary, if not almost bad surgery, when applied to foreign bodies of a non-penetrating variety; and when one contrasts the rapid recovery with the minimum of inconvenience to the patient of endoscopic methods, as compared with the more serious character of and prolonged convalescence from external surgical procedures on the oesophagus, the latter should be considered by all surgeons as out of date, unless the circumstances are very exceptional; such methods as blindly groping with probangs, etc., should only be mentioned to be condemned.

CASE V.—Meccano Wheel Impacted in the Oesophagus Opposite the Third Dorsal Vertebra.

The patient, a boy aged 6½, was admitted to the Portsmouth Eye and Ear Hospital on December 5th, 1922, with a history of having swallowed a meccano wheel, through which he was trying to whistle. The radiograph (Fig. 3) shows its position as stated above.

This is the type of case where up to recent years (and even possibly nowadays) a probang would be used to push the foreign body downwards, to be passed per rectum, with probably no great inconvenience to the patient; but the ease with which it can be seen and removed by endoscopic methods, as was done in this case, with the elimination of any possible subsequent complications or damage to the oesophageal walls, still further renders the use of such instruments as the probang inadvisable when other methods are available. As regards the technique to be observed in endoscopic manoeuvres such as the foregoing cases entailed, the conclusions arrived at from these and other cases are as follows:

1. *Position of the Patient.*—If the manoeuvre is to be carried out under a local anaesthetic, which is only possible in a certain proportion of cases, the patient should sit on a low stool, with the head in the "sword-swallowing" position

—that is, extended fully, chin pointing upwards; if under a general anaesthetic, the patient should lie in the dorsal position, head over the end of the table, supported so as to bring the chin as nearly as possible level with the prominence of the thyroid cartilage. The patient as a whole should be on an inclined plane, head lowest, so as to obviate the occurrence which happened in Case I, of the foreign body slipping back if escaping from the grip of the forceps.

2. Before operation, in the case of adults a hypodermic injection of 1/150 grain of atropine should be given fifteen minutes before commencing, and in the case of children under 12 years of age 5 to 10 drops of tincture of belladonna, according to the age of the child, by the mouth. This will be found very useful in preventing undue accumulations of mucus. In nervous adults also 1/6 to 1/4 grain of morphine hypodermically will assist by calming the patient.

3. *Choice of Anaesthetic.*—As it is of great importance that the field of vision be unimpeded by collections of mucus, C.E. mixture, followed by pure chloroform, has been found of greatest service. In the case of adults, whose control is good, a local anaesthetic may be used with advantage; it will, however, take from ten to fifteen minutes to prepare the fauces and pharynx by painting with from 5 to 10 per cent. cocaine before complete tolerance is obtained, and a stimulant such as sal volatile should be at hand in case of fainting or collapse. Some distinguished endoscopists claim to use little or no local anaesthetic and to be able to induce their patients to allow them to pass their instruments. One regrets that one's own experience differs from this.

4. *Position of Surgeon.*—If the patient is under a local anaesthetic, the surgeon stands while the patient sits on a low stool. If the patient is under a general anaesthetic, the surgeon sits on a low stool—a dressing-box makes an admirable seat.

5. *Treatment of Tubes.*—The tube should be warmed and smeared with glycerin as a lubricant; a cold tube excites spasm.

6. Lastly—a small but practical point—if the surgeon is wearing glasses himself, these should be well warmed or smeared with Sterilla soap, otherwise he is liable to find his own vision fogged just when he most particularly wishes to see clearly.

FIG. 3.—Case V: Meccano wheel in oesophagus.

"LUNG SPLINTING" IN THE TREATMENT OF PULMONARY TUBERCULOSIS.*

BY

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This paper represents an attempt to work from evidence ascertainable by the clinician towards treatment in pulmonary tuberculosis. Practically any organ in the body may be attacked by tubercle; the frequency and course of the pulmonary lesion then raises the question of the significance of this particular condition. Fuller appreciation of Koch's experiments, which demonstrated the behaviour of immunized cells to tuberculous infection, forces the attitude that pulmonary tubercle is a phase in tuberculosis having defensive properties, and probably supplementing the lymphatic system in guarding against spread to other parts. This defensive element must receive consideration in treatment. The majority of serious therapeutic attempts have at their foundation the production of immunity. This phase of tuberculosis is ill defined and the results would appear to justify experiment in supplementary or other directions.

Taking these facts into consideration I studied, on a comparative basis, various manifestations of tuberculosis. The following observations would seem to establish *rest of the diseased organ* as a fundamental in treatment. The dis-

cussion of the introduction of rest by lung splinting in the treatment of pulmonary tuberculosis can be dealt with most logically under three headings.

I. Facts which Point to Immobilization as being a Rational Procedure in Treatment.

I first studied the deaths incident to the various tuberculous lesions. The following list,¹ representing the deaths in a large Midland city, is cited as a basis of argument:

Pulmonary tuberculosis	...	...	...	1,171
Tubercle of abdomen	...	...	...	55
Tubercle of spinal column and joints	...	...	...	31
Tuberculous meningitis	...	...	...	74
Disseminated tuberculosis	...	...	...	20
Tubercle of glands and other parts	...	...	...	11

In the above table we notice that mortality from tuberculosis is mainly associated with organs whose function involves movement. Tubercle in what may be described as stationary organs accounts for a comparatively small number of deaths.

I next considered this association of tuberculosis and mobile organs clinically. To this end I divided up the various common lesions for comparison as follows: (a) Disease in the stationary organs—for example, glands; (b) disease in organs which are mobile but capable of being immobilized—for example, joints; (c) disease in mobile organs which are uncontrolled—for example, lungs. The large majority of cases falls into the third category.

Study of these three chronic types of tuberculosis soon

* Abstract of a communication to the Ulster Medical Society.

reveals the fact that natural or mechanical immobilization is not associated with anything like the systemic toxæmia or the incidence of metastases that are so common in cases of pulmonary disease. Those who have been associated with considerable numbers of patients suffering from progressive pulmonary tuberculosis and, say, osseous lesions, must have noticed that Nature can exert healing properties in the latter conditions when resting, while the pulmonary disease is slowly increasing. That this is due to secondary infections in the lung is improbable since the manifestations are those of tuberculous infections. Or again, it may be necessary to make allowance for tissue susceptibility, but, comparing one tuberculous joint immobilized with another free, there is little difficulty in deciding that movement is trauma—when it is in a joint. The fact I want to emphasize is that the introduction of movement produces a baneful influence.

As a corollary to this reasoning, if movement be a factor responsible for the progressive toxæmia and the spread of the disease to other parts of the body, then immobilization should unquestionably produce beneficial results. As far as toxæmia is concerned we have proof of the beneficial effect of low-tension artificial pneumothorax.¹ With regard to metastasis, trustworthy evidence of spread of disease from a lung whose respiratory excursion is restrained is not available.

There are probably several factors which determine the incidence of tuberculosis, but once disease is established movement would doubtless be of importance in causing extension to other parts of the lung or body, and, on the analogy of the tuberculous joint, would retard healing.

Again, let me remind the reader that one of the earliest manifestations of tuberculous disease in a joint is muscular rigidity—that is, Nature attempting to splint and produce rest. This same effort at restraint by Nature is also found in pulmonary disease, though less manifest. The reduced movement occurring over a diseased lung indicates the possibility of lung splinting, despite the bilateral character of respiratory movement.

With regard to the question of auto-intoxication, I think we may assume, considering the effect of immobilization, that the chief factor involved in the dissemination of tuberculous toxins is the respiratory disturbance of the diseased lung.

Consideration of these facts would suggest that treatment should have as its object the promotion of healing of the lung lesion and also the prevention of metastases and toxæmia. With this end in view it is absolutely necessary to produce a resting condition not only of the lesion, but also of the adjacent healthy, or comparatively healthy, lung tissue.

II. Immobilization by Means of an External Splint.

If the introductory reasoning be regarded as sound, it is necessary to develop a means of immobilization which is capable of a comparatively wide application. From time to time attempts have been made to restrain or prevent lung action with therapeutic intention. The most outstanding instance is that of artificial pneumothorax. Other methods of restraining lung activity have been employed, such as mechanical restraint by means of adhesive strapping or by a belt, introduced by Denison² and Sewall³ respectively. Webb⁴ introduced rest of individual lung by posture. More recently Knopf⁵ has suggested a method of pronounced diaphragmatic breathing by means of which respirations may be reduced to 5 to 10 a minute. All of these workers were convinced of the beneficial effects following lessened activity.

Working on the lines indicated I set about inventing a device which would take cognizance, at least to some extent, of the three factors in respiration—namely, rib movement, diaphragmatic movement, and lung movement. The device I have called a lung splint. Its character will be evident from a study of the accompanying illustration.

All parts were suitably padded and made so light and comfortable that it was possible to wear the splint continuously. A light woollen garment was preferably worn next the skin. The patient expired completely and the straps were just comfortably tightened on the chest wall in this position, a small pad being used above and below the clavicle. The degree of immobilization was gradually increased, so that the patient became inured without any real discomfort. Notable features of this appliance are that the limbs have free movement; there is no vital impairment of the opposite lung; a certain amount of lateral spinal movement is possible, a striking feature being that leaning to either side increases the tension of the restraining belts. This apparatus was perfected by Messrs. Salt and Son, Ltd., 5 and 6, Cherry Street, Birmingham, and is manufactured by this firm.

III. Effects of Lung Splinting.

The fact that tuberculous lesions in one part can exert healing properties while those in other parts are progressing unfavourably, would suggest that healing in tuberculosis is primarily a local effort. The effects, then, of a procedure which recognizes the importance of the local condition demand consideration. I shall indicate briefly how it appears to me restriction by means of this splint is effected.

By relaxation of the costo-sternal portion of the diaphragm

contraction of the crus does not bring about the piston action which results in the lowering of the diaphragm. With regard to the ribs, these are intimately associated in producing enlargement of the thoracic cavity. Enlargement in turn causes expansion in all parts of the lung capable of functioning. Tendeloo's law is not now accepted, as Keith has shown that lowering of the diaphragm produces an effect even at the apex of the lung. No doubt the degree of expansion in different areas has some relation to the adjacent portion of the expanding mechanism. It is quite evident, therefore, that fixation of the ribs in the position of expiration together with impairment of diaphragmatic function will effect very considerable diminution of lung movement. Splinting takes

these facts into consideration and, what is equally important, recognizes the fact that rest which does not extend to the healthier part of the lung defeats its own object.

The first effect of lung splinting that has to be recorded is that it is possible to restrain lung activity. Respiratory function seems to fall mainly on the lower two-thirds of the free lung. The reader is referred to the spirometric readings shown for each of the cases reported below. This opens up an interesting field of research in that the relative functioning of the lungs can be investigated.

Since my object in this preliminary investigation was not so much to publish results as to determine effects of splinting, I chose four afebrile patients who had been resident over periods as indicated below, and whose response to routine sanatorium treatment had been unsatisfactory or had been outlived. In this way contributory factors were eliminated as far as possible.

CASE I.

J. J., male, aged 18; admitted January 14th, 1921. He was chosen because he was a case of pulmonary tuberculosis for whom apparently nothing could be done. His condition was getting worse. Right lung splinted March 13th, 1922.

Spirometric Readings: Free, 3,760. Right lung splinted, 3,500. Left lung splinted, 3,380.

Condition Before Splinting.—Right lung infiltrated with crepitations throughout. Crepitations in left lung, with slight infiltration of upper third. There was morning and evening cough. Sputum (twenty-four hours): 1 ounce; numerous tubercle bacilli. There was frequent pleuritic pain. Haemoptysis: Clots four months previously. Musculature poor; marked languor, and poor capacity for work; variable appetite; frequent night-sweats; marked dyspnoea. Blood pressure, 114/70.

Condition After Wearing Splint Seven Months.—A few crepitations in right lung, above clavicle and at lower apex. No moisture in left lung. No cough, sputum, tubercle bacilli, or pleuritic pain. Haemoptysis: Staining during influenza four months ago. The musculature was greatly improved; he felt fit for work; his appetite was good; there were no night-sweats, and the dyspnoea had greatly improved. Blood pressure, 128/80.

Left lung splint. Total weight = 2½-3 lb. A small elbow-lever on hip pad prevents perineal strap chafing right thigh. Fulcrum of supporting lever about point where spinal movements independent of pelvis cease.

This patient has made phenomenal progress. The improvement in the left lung has probably something to do with the limitation of antero-posterior thoracic enlargement.

CASE II.

T. W., male, aged 34; admitted July 19th, 1921. Chosen because he was a case of chronic bronchitis with clinical pulmonary tuberculosis. I thought sputum might be retained where the bronchial tubes were inflamed if immobilization were attempted. The condition was getting worse. He was particularly unsatisfactory at the time of splinting as he had just suffered from a sharp attack of influenza. Left lung splinted March 13th, 1922.

Spirometric Readings: Free, 3,006. Left lung splinted, 2,900. Right lung splinted, 2,470.

Condition Before Splinting.—Crepitations in left lung to sixth rib anteriorly and angle of scapula posteriorly. Rhonchi throughout chest. Cough troublesome in the morning. Sputum (twenty-four hours): 1 ounce; no tubercle bacilli. The musculature was good; there was marked languor, and poor capacity for work; appetite good; occasional night-sweats; marked dyspnoea on exertion. Blood pressure, 122/70.

Condition After Wearing Splint Seven Months.—Crepitations apex to second rib and in suprascapular region. Rhonchi throughout chest. No cough. Sputum, half an ounce; no tubercle bacilli. Languor gone, and capacity for work greatly improved; appetite good; no night-sweats; marked dyspnoea on exertion. Blood pressure, 124/80.

This patient claims that he feels greatly improved and is anxious to go out to work. No evidence of sputum retention.

CASE III.

W. G. C., male, aged 19; admitted May 31st, 1921. Chosen because he was an advanced case having very frequent haemoptysis. The left lung was the more actively diseased, and I guessed the blood had its origin in this lung. He was very weak and the outlook was unfavourable. In addition infiltration in the right lung extended below the third rib. I was anxious to see what effect would be produced in the right lung if the left were splinted. Left lung splinted March 13th, 1922.

Spirometric Readings: Free, 2,220. Left lung splinted, 1,900. Right lung splinted, 1,756.

Condition Before Splinting.—Crepitations and infiltration throughout left lung; cavitation at inferior angle of scapula. Crepitations over upper half of right lung; less marked infiltration throughout. Cough severe in early morning. Sputum (twenty-four hours): 1½ to 2 ounces; numerous tubercle bacilli. Frequent haemoptysis; sometimes twice in same week. Musculature poor; marked languor; felt unfit for work; appetite fair; no night-sweats; marked dyspnoea. Blood pressure, 104/58.

Condition After Wearing Splint Seven Months.—Crepitations in upper half of left lung; evidence of fibrosis going on; cavity dry. Disease more active in right lung. Very slight cough. Sputum, 1½ ounces; few tubercle bacilli (both sputum and bacilli less at end of June). Free from haemoptysis up to July 10th; faint streaks occasionally since. Musculature improved; feels well; capacity for work improved; as also had appetite to end of June; dyspnoea not so marked. Blood pressure, 115/70.

This patient claims that he is much improved since the splint was applied. Note cessation of haemoptysis. There is no doubt he made considerable progress up to the end of June. I noted then that the right lung was not so satisfactory. Sputum, etc., increased slightly. I am doubtful with regard to the ultimate result, though the feeling of well-being remains.

CASE IV.

E. M., female, aged 28; admitted August 12th, 1921. Chosen because she was a well marked case of pulmonary tuberculosis showing evidence of failing resistance, also because she was physically frail. Left lung splinted May 1st, 1922.

Spirometric Readings:—Free, 2,030. Left lung splinted, 1,920. Right lung splinted, 1,640.

Condition Before Splinting.—Marked disease with crepitations throughout left lung. A few crepitations at apex of right lung. Severe cough, causing vomiting each morning. Sputum (twenty-four hours): 1 ounce; tubercle bacilli fairly numerous. Haemoptysis once, nine months previously. Musculature poor; marked languor; poor capacity for work; appetite fair; marked dyspnoea on exertion. Blood pressure, 105/60.

Condition After Wearing Splint Five Months.—Left lung: Post-tussic crepitations only above and below clavicle and in suprascapular region. Right lung: No moisture. No cough. Sputum practically gone; no tubercle bacilli. Musculature good; fit for work; appetite good; dyspnoea greatly improved. Blood pressure, 110/72.

There is no doubt about the improvement in this patient.

The question of blood pressure is interesting. One would expect a certain lowering as a result of impaired thoracic movement. Having regard to this, and also the possibility of patients in the circumstances manifesting a certain amount of excitement, I am bound to say that I think there is room for feeling that the increase in pressure, especially diastolic pressure, is evidence of lessened toxæmia.

My object, however, was mainly to record effects, and this I have done as faithfully as I can. Perhaps I should emphasize that my observations do not include a claim that complete immobilization of the diseased lung is established. My contention is that movement would seem to be restrained to a degree approaching what might be termed rest. Excision

of a portion of the second rib as an adjunct is contemplated if necessary.

So far I am not sure that there are any contraindications to the use of this lung splint. Even in the very advanced Case III there is little doubt that the patient benefited. Apart from slight retraction of the side splinted no untoward effect noticed has escaped record.

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Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

A FEATHER IN THE PAROTID DUCT.

In the abstract No. 168 of the *Epitome* of February 24th, on the subject of salivary calculi, reference is made to the possibility of a foreign body forming the nucleus of the concretion. This reminds me of an instance of a foreign body in the parotid duct, which is unique in my experience.

Some years ago a small child was referred to me at the Central London Throat and Ear Hospital on account of inability to open the mouth and the presence of a large painful swelling extending backwards and downwards from the right parotid region. The swelling was obviously an abscess on the point of bursting externally. I was able to force the mouth open sufficiently to allow me to see a small white object projecting from the orifice of Steno's duct. I pulled it out and found it to be the tip of a feather, which was about an inch in length. Evacuation of the pus by a simple incision was soon followed by complete recovery. The feather, which had evidently come out of the child's pillow, had been accidentally drawn into the mouth. The stem had entered the parotid duct, and the feather had apparently worked its way inwards in the same fashion as a spike of grass when put inside the coat sleeve, in the familiar trick of our childhood.

London, W.

JAMES DUNDAS-GRANT, K.B.E., M.D.

MENINGITIS DUE TO PFEIFFER'S BACILLUS.

MENINGITIS associated with the presence of Pfeiffer's bacillus in the cerebro-spinal fluid is still sufficiently uncommon to deserve record. In the following case, as the cerebro-spinal fluid eventually became normal, it would appear that recovery ensued from the meningitis, the patient dying from pulmonary complications.

S. G., aged 62, had been operated upon twenty years previously for bilateral empyema of the antrum of Highmore; the sinuses were kept open by gold fillings in tooth sockets, and the patient continued to irrigate the antra daily. For the past five years he had suffered from recurrent attacks of nasal catarrh at very frequent intervals. The nose was examined, polypi diagnosed, and operation advised. At the time of removing the nasal polypi pulsation through what appeared to be a small deficiency in the cribriform plate of the ethmoid was noted.

Rigors occurred within a very short time of the operation, and three days later, the temperature having risen to 101.8° F., with pulse rate of 90, the patient began to complain of intense backache and frontal headache. His mental condition was normal, pupils small but active to light and accommodation, optic discs and other cranial nerves normal. The remaining physical signs were as follows: general cutaneous hyperæsthesia, slight rigidity of cervical muscles, no apparent spinal rigidity, Kernig's sign positive, knee and ankle jerks sluggish, abdominal reflexes sluggish and equal, plantar reflexes flexor with active withdrawal of the leg; heart and lungs normal. On lumbar puncture a turbid yellowish fluid under slightly increased pressure was obtained; when microscopically examined numerous polymorphonuclear cells and a few mononuclears were seen, but no organisms. On culture, Dr. Clement Lovell reported the presence of an organism showing the following characteristics: "A short Gram-negative bacillus growing only on blood agar or agar smeared with blood. Subcultures are more vigorous. No fermentation with glucose, maltose, or saccharose; a slight deposit in broth. The organism is non-pathogenic to the guinea-pig (Pfeiffer's bacillus)."

During the following week occasional delirium and retention of urine occurred, but the physical signs remained practically unaltered. Two doses of Pfeiffer's bacillus vaccine were administered, 5 and 10 million organisms respectively, the second dose being