FOREIGN BODIES OF DENTAL ORIGIN IN A BRONCHUS PULMONARY COMPLICATION*

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Foreign bodies of various kinds are undoubtedly lodged in the bronchi more frequently than they are recognized. Weist reported 1000 cases; 103 (10.3 per cent.) only were from the literature, 897 (89.7 per cent.) were unpublished cases collected by Weist by personal communications. It would seem possible that a correspondingly large proportion of cases of dental origin remains unpublished.

Foreign bodies of dental origin include teeth, dentures, instruments, and other material used in dental operations. Aspiration of infected blood or sputum is probably a more frequent source of infection than foreign bodies. The occurrence of such infection is obviously greatly more difficult to prove, but the frequency of gross mouth infection in patients subjected to dental operations needs hardly be mentioned.

There have been at the Mayo Clinic during the past four years 7 cases of pulmonary suppuration following dental operations or trauma. In 2 cases the tooth was spontaneously expelled; in one it was discharged through a thoracotomy wound, and in one it was found at postmortem. In the other cases no foreign body was found, but it is quite probable that they were also cases of infection from inhalation.

I observed 6 of the 7 cases and have collected 45 proved cases from the literature. These 52 cases form the basis of this report.

FOREIGN BODIES IN THE 52 CASES

Teeth	37
Artificial teeth	4
Dentures	2
Root canal broach	2
Dental burr	3
Allen's dental cement	1
Plaster of Paris	1
Hard rubber from gag	1
Blade of forceps	1

The foreign body was lodged in the right bronchus in 21 cases, in the left bronchus in 19, in both sides in 1, and in the trachea in 1; the location was not stated in 10. The bodies were most frequently in the right lower lobe.

In 26 cases the accident occurred during extraction under general anæs-

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thesia, in 12 under nitrous oxide, in 11 under ether, and in 3 under chloroform. In 3 cases false teeth were inspired; in 4 cases the foreign body was inspired during dental operations without anæsthesia.

The literature contains more or less fragmentary reports of other similar cases (Carpenter, Ricketts, Stokes, McCrae).

Symptoms and Signs.—The symptoms may be divided into those which are manifest immediately following the inhalation of the foreign body, and those which arise from its prolonged presence in the respiratory tract. The most constant and characteristic immediate symptom is cough of varying intensity and persistence; associated symptoms are dyspnœa, cyanosis, wheezy respiration, pain in the chest, and nausea. In the 52 cases cough, more or less violent and spasmodic, was an immediate symptom in 27, pain or soreness in the chest in 13, and dyspnœa in 10. In one instance cough started after twenty-four hours, in another after four days. In 12 there was no cough. In 4 cases dyspnœa of a varying grade was the presenting symptom. In one only was there a sensation of a foreign body in a bronchus. It is noteworthy that in 7 cases (13.4 per cent.) there were no symptoms whatsoever. In 16 of the series there were no serious pulmonary infections; in the remaining 36 there was evidence of pulmonary suppuration of varying grade. For convenience, in the further discussion the cases will be grouped on this basis.

In the 16 uncomplicated cases the accident occurred during general anæsthesia in 4, and during alcoholic intoxication in 1. No anæsthesia was used in 2, and no statement was made as to anæsthesia in 9. Symptoms were marked in 7, and not mentioned in 9. A diagnosis was made by the X-ray in 5; in 1 the plate showed only pleural thickening. In 8 there was no mention of an X-ray examination. With two exceptions the length of time the foreign body was present in the bronchus was short. In one a tooth was coughed up after three years; in another plaster-of-Paris fragments had been present for five years without symptoms other than a persistent spasmodic cough.

The foreign material was spontaneously expelled in 4 cases on the third day, the fifth day, during the third month, and three years after the accident, respectively. Early bronchoscopic removal was effected in 10. Two patients died, one from typhoid fever ten days after bronchoscopy, and one from tuberculosis following temporary recovery from an unsuccessful thoracotomy.

Complications.—This group comprised 36 cases. In 22 the accident occurred during the extraction of teeth under general anæsthesia; in 2 others in which it followed extraction the anæsthesia was not mentioned; in 2 loose artificial teeth or dentures were inhaled; in 1 a tooth was inhaled during a general anæsthetic for an abdominal operation; in 1 pulmonary infection followed a kick in the face by a horse, resulting in the loss of several teeth.

Immediate Symptoms.—In this group cough of varying severity asso-

ciated with other symptoms, such as dyspnœa, cyanosis, and pain in the chest, was manifest in 11. In 7 cases cough was the only symptom; in 3 there was no cough; in 10 there were no immediate symptoms, or they were so mild and transitory as to be practically negligible.

A latent symptomless period was present in 15. The length of the latent period was two weeks or under in 3, between two weeks and two months in 7, more than two months and under one year in 2, two years in 1, and eleven and one-half years in 1. There was no latent period in 13. The records in the remaining cases were indefinite on this point.

Late Symptoms.—Cough, usually with purulent sputum, was present in 29 cases, hæmoptysis in 8, and pain in the chest in 11. The onset of late symptoms was gradual and without any intervening symptomless period in at least 13. The relation was not stated in 8. X-ray reports were mentioned in 16. The plates showed the foreign body in only 4 cases, an artificial tooth with a piece of denture in 1, a tooth in 2, and a dental burr in 1. Abscess was shown in 5 cases; one case diagnosed tuberculosis proved on postmortem to be bronchiectasis. A fluoroscopic examination revealed limitation of movement of the diaphragm in one case; negative X-ray findings for foreign body were reported in 12 cases.

It would appear on first thought that a diagnosis should be established by the fact that a foreign body passed down the pharynx. In the present series of cases the patient was usually unconscious at the time of the accident. In one case (Carpenter's) the patient believed that he had swallowed, not inspired, a denture with four teeth; its presence in the lung was never suspected and was only proved at postmortem after thirteen years. In one case only (Hubbard's) did the patient insist that the foreign body was in the lung in spite of negative X-ray and other findings.

In cases without immediate severe symptoms the operator may believe or fervently hope that the foreign body passed down the œsophagus instead of the trachea. In one case (Jarvis's) the dentist obviously had such hopes, in spite of the fact that the patient, a physician, had paroxysmal cough and other characteristic symptoms of foreign body in a bronchus immediately on awakening from anæsthesia. When the patient asked to see the tooth the dentist explained that it had broken and was thrown away. Three months later the physician coughed up the tooth.

In cases of multiple extraction, as in 22 instances in this series, a tooth or stump of a tooth is easily lost without being missed.

Treatment.—Bronchoscopy was done for the removal of foreign bodies in 5 cases, in 3 of which the X-ray showed the foreign body. In the fourth case a second X-ray plate, taken after a positive clinical diagnosis of foreign body had been made, showed the foreign body. In the fifth case no X-ray was taken. In 2 of these cases the foreign body was removed at the first attempt; in 1 two unsuccessful high bronchoscopies were followed by a third successful low bronchoscopy after tracheotomy; in a fourth the bronchoscopies failed. Doctor Jackson had seen this case

and believed the foreign body to be beyond reach of the bronchoscope. In still another case in which bronchoscopy failed, a first-stage operation was done for drainage and the patient died before the second-stage operation had been undertaken. Thoracotomy was done in 15 cases; in 2 of these the lung was resected. In the remaining 13 cases the operation was done for drainage of the suppurating process.

Results.—Fourteen of the 36 patients with complications died; 16 made a complete recovery, and the result in the remaining 6 cases is not definitely stated. There were seven deaths in the 24 cases occurring since 1900.

Seven of the 14 patients who spontaneously expelled the foreign body recovered, and 3 died; the ultimate result was not stated or was uncertain in 4. In 3 cases an abscess requiring drainage developed after the foreign body had been expelled; in one case the foreign body was discharged through the drainage wound, and in one case the tooth was expelled after two and one-half years. Seven months later an abscess developed, and after two months the patient died. In 15 cases in which thoracotomy was performed 2 were followed by resection of the lung; both patients died; 1 died of exhaustion, and 1 of pulmonary embolus before the second-stage drainage operation. One died while being chloroformed for drainage operation. One improved so markedly following the preliminary rib-resection that the second-stage operation was not done. In the remaining 11 cases, 1 patient died, 1 was greatly improved, and 9 made a complete recovery.

POSTMORTEM FINDINGS IN 9 FATAL CASES

1. Bilateral bronchiectasis, empyema, tooth in bronchus.
2. Pulmonary embolism.
3. Large empyema fistula in lung, denture in pleural cavity.
4. Abscess, ulcerated bronchus, tuberculosis.
5. Abscess, tooth in bronchus.
6. Abscess, empyema, tooth in bronchus.
7. Massive gangrene of entire lung, tooth obstructing bronchus.
8. Bilateral lower lobe bronchiectasis, tuberculosis, tooth in bronchus.
9. Bronchiectatsis, pericarditis, tooth in bronchus.

DISCUSSION

In this series of cases the relationship between multiple extractions of teeth under general anæsthesia and pulmonary complication is striking. Multiple extractions under general anæsthesia were performed in 22 instances. Aspirative infection as a cause for pulmonary suppuration may probably be assumed to be sufficiently evident in the cases in which the tooth was later expelled, or in which an impacted tooth was found in the midst of a suppurative or gangrenous process in the lung. Perhaps the most striking evidence of all is shown in the case of Israël, in which a

tooth was found in an actinomycotic abscess of the lung. That aspiration of infected material from the mouth independent of teeth is a large factor in the causation of pulmonary infection cannot be so clearly demonstrated in the individual case, but much evidence has accumulated indicating that aspiration of infected material is one of the most common causes of abscess, gangrene, and bronchiectatsis. As early as 1877, Schüller found that the introduction of clean foods into bronchi of rabbits through tracheal wounds is practically harmless, while the introduction of the same foods mixed with bacteria and filth results in a fatal pneumonia. Lung abscess following tonsillectomy has been reported frequently (Manges, Tewksbury, Bassin, Frank, and others). Külbs found bad teeth and tartar (Zahnstein) in a large proportion of cases of lung abscess in which he operated. In a series of 56 cases of pulmonary suppuration at the Mayo Clinic in which operation was done, aspiration of an infection was probable in 25 per cent.; the etiology was questionable in another 25 per cent., but it is probable that a large proportion of these were cases of aspirative infection.

The importance of early recognition of a foreign body in a bronchus is emphasized by the fact that in this series there was no mortality in the cases in which it was expelled or removed early by bronchoscopy. All the fatalities, with the exception of one death following lung resection, were in cases in which the foreign body had been present for a long period.

Positive diagnosis may be made by means of the history, the X-ray, or by bronchoscopy. It is important to remember, however, that each and all of these may be negative in the presence of a foreign body, as in 12 cases in this series. Symptoms and signs are suggestive, but in themselves are rarely conclusive. In many cases they have led to an erroneous diagnosis of tuberculosis.

The history of the case is of first importance. If the operator knows that a tooth has passed down the pharynx, and the patient immediately develops symptoms of bronchial irritation, the diagnosis is obvious. Even in the absence of symptoms, it should be assumed that the foreign body passed down the trachea rather than the œsophagus until the contrary is proved. No marked immediate symptoms occurred in 9 of the 22 cases and there was a later symptomless period in 16 of 35 cases. In one case it was of thirteen years' duration. The profession has been slow to recognize that a symptomless period does not constitute proof of absence of a foreign body. Jackson writes on this point: "Practitioners are heedless of and even scoff at the patient's suspicions that a long previously aspirated (or swallowed)[1] foreign body is the cause of present symptoms."

Examination by the X-ray is indispensable, and a positive plate establishes the diagnosis both as to the presence and the location of the foreign body. A negative X-ray, however, is not conclusive and in the presence of a diffuse shadow from pulmonary suppuration is of doubtful value. In

[1] Inserted by the author.

the 16 uncomplicated cases in this series, the X-ray was positive in 6 of the 7 cases examined, but in the group with complications it failed to show the foreign body in 12 of the 16 cases examined.

In early uncomplicated cases bronchoscopy in skillful hands is the best method of diagnosis and of removal. The indications for bronchoscopy for a foreign body as enunciated by Chevalier Jackson are as follows:

1. The appearance in the röntgenogram of a foreign body or of any suspicious shadow.

2. Cases in which a clear history is given of the patient's having choked on a foreign body, and in which the foreign body was not afterwards found.

3. Cases in which there are signs of stenosis of the trachea or the bronchus.

4. In any case suspected of bronchiectasis.

5. In the absence of any history of a foreign body, the patient giving symptoms of pulmonary tuberculosis, without the finding of bacilli in the sputum, and especially if the physical signs are at the right base, and above all, if there are also physical signs of pleural effusion.

6. In case of doubt, bronchoscopy should be done.

Jackson recognizes no absolute contra-indications to bronchoscopy.

TREATMENT

Expectant treatment is employed in the hope that the foreign body may be expelled spontaneously; bronchoscopy and thoracotomy are the alternatives, after the foreign body has been recognized.

The question of the likelihood of the expulsion of the foreign body is often raised in the consideration of the advisability of bronchoscopy. In this series the tooth was expelled in only 3 of 13 cases before the onset of pulmonary suppuration. The tooth was expelled in 13 of 33 cases after suppuration had developed. Six of these patients recovered, but thoracotomy had to be done in 4 instances. Three patients who received no further treatment died. Jackson's attitude toward the question of spontaneous expulsion is as follows: "We do full justice to our patients when we tell them that while the foreign body may be coughed up, it is very dangerous to wait; and further that the difficulty of removal increases with each hour the body is allowed to remain."

If the foreign body has not been recognized, however, or the patient has been treated expectantly until suppuration has set in, the results following bronchoscopy are not so favorable. In 5 such cases in this series in which bronchoscopy was done the foreign body was removed in only one. It may be impossible to locate the tooth and it must be seen in order to be removed. Furthermore, its removal in the presence of pulmonary suppuration becomes only an incident. The important consideration in such cases is the suppurating focus. For this complication thoracotomy for drainage has given the best results. If the focus is in the form of a localized solitary abscess, a drainage operation is the

operation of choice. If the cavity is multilocular or if there is a bronchiectasis, any form of treatment is likely to yield a high morbidity and mortality. Massive gangrene is uniformly and quickly fatal.

The table of postmortem findings is uncontrovertible evidence of the possible etiologic relationship of foreign body aspiration to abscess, gangrene, and bronchiectasis.

With regard to details of dental operative technic for prevention of accidental aspiration of foreign bodies, Doctor Gardner of the Mayo Clinic in a personal communication expressed himself as follows:

" The patient should be watched quite as carefully with a local anæsthetic as with a general. The use of gauze sponges in no way interferes with the work of the operator; it prevents the inhalation of a foreign body during operation and cares also for the hemorrhage. Furthermore, the dentist may, by careful examination of the teeth before operation, ascertain if the work might displace pieces of tartar, fillings, or even the teeth themselves during a general anæsthetic. The condition of the patient undergoing any operation often requires the use of a gag during an ether anæsthetic, and the anæsthetist should know the condition of the patient's teeth before the anæsthetic is started, since such an instrument often displaces from a tooth foreign bodies which might be inhaled."

SUMMARY

1. Aspiration infection of the lungs is most common in operations about the mouth following general anæsthesia.

2. Symptoms may be immediate and continuous or there may be an intervening symptomless period of months or years. There may be no immediate symptoms.

3. The most constant and characteristic immediate symptoms are cough, dyspnœa, wheezy respiration, and pain in the chest. The late symptoms in varying number and degree are those of pulmonary suppuration.

4. Late symptoms of foreign-body infection often simulate phthisis, and that is the diagnosis often made.

5. Positive diagnosis rests essentially on history-taking, X-ray, and bronchoscopy. The history may be that of having " swallowed " the foreign body.

6. Bronchoscopy for diagnosis is indicated in any early doubtful case.

7. Spontaneous expulsion of small irregular foreign bodies of high specific gravity, especially teeth, is always doubtful. Spontaneous expulsion often occurs only after an abscess has formed.

8. Bronchoscopy is the only treatment to be considered in early uncomplicated cases. In cases in which there is suppuration, thoracotomy for drainage gives the best results.

9. In fatal cases death is usually due to abscess, bronchiectasis, or gangrene of the lung, any of which may be complicated by empyema.

10. Tuberculosis may coexist with a suppurative process.

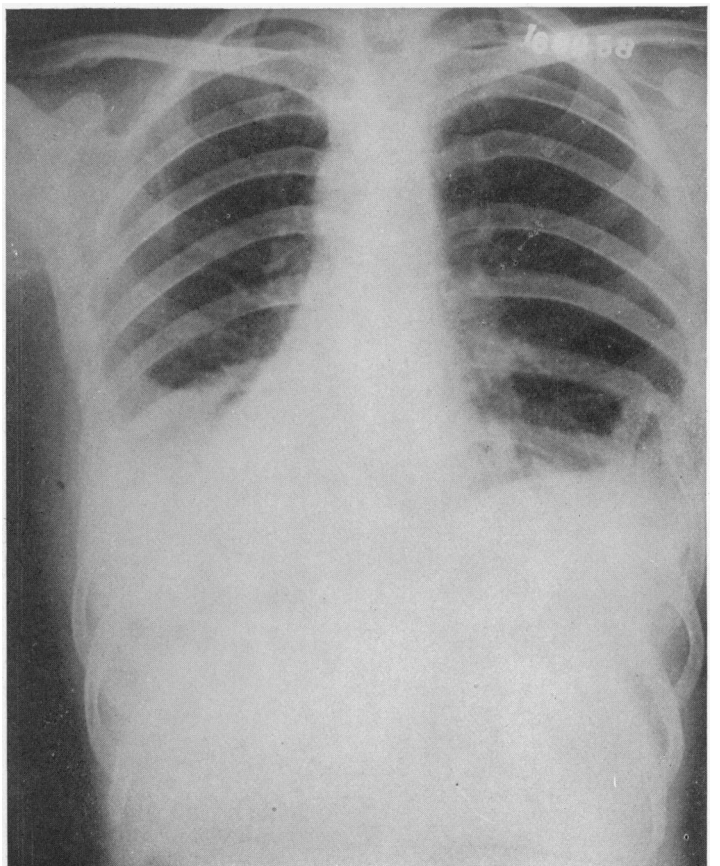

FIG. 1.—(169958) Röntgenogram made eight months after teeth extraction.

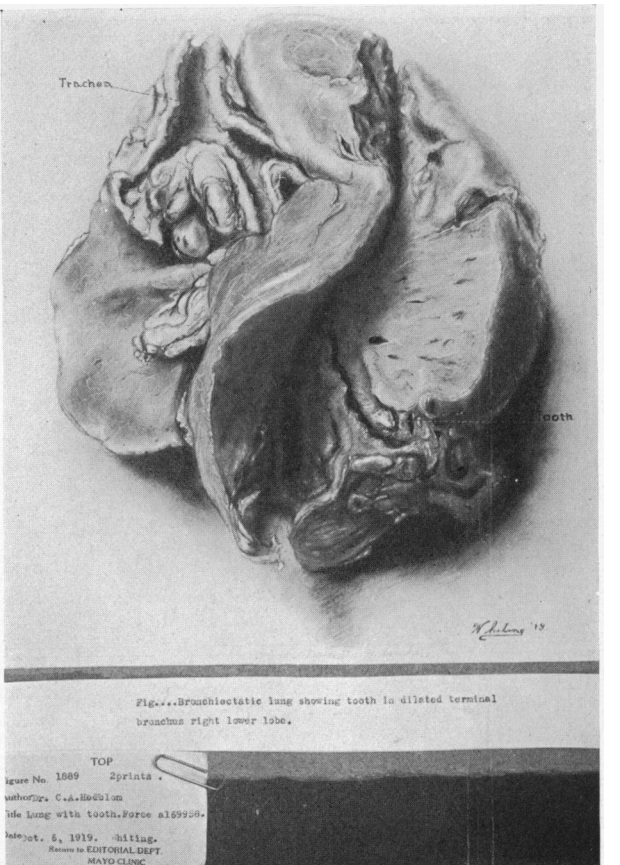

FIG. 2.—(169958) Drawing of bronchiectatic lung, showing tooth in dilated terminal bronchus of right lower lobe.

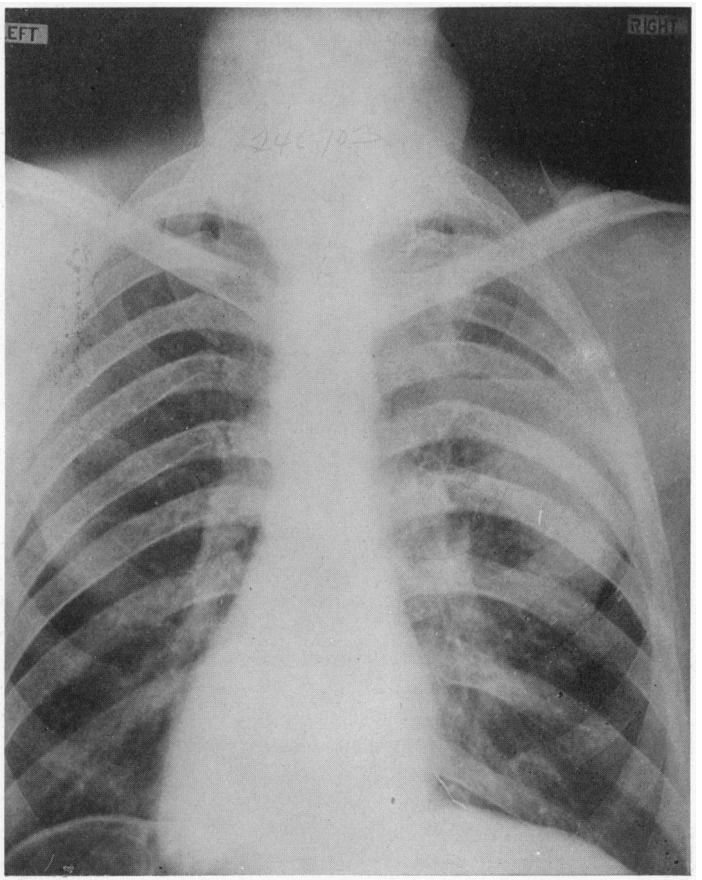

FIG. 3.—(240703) Röntgenogram made before operation about two and one-half months after teeth extraction. Note the fluid level

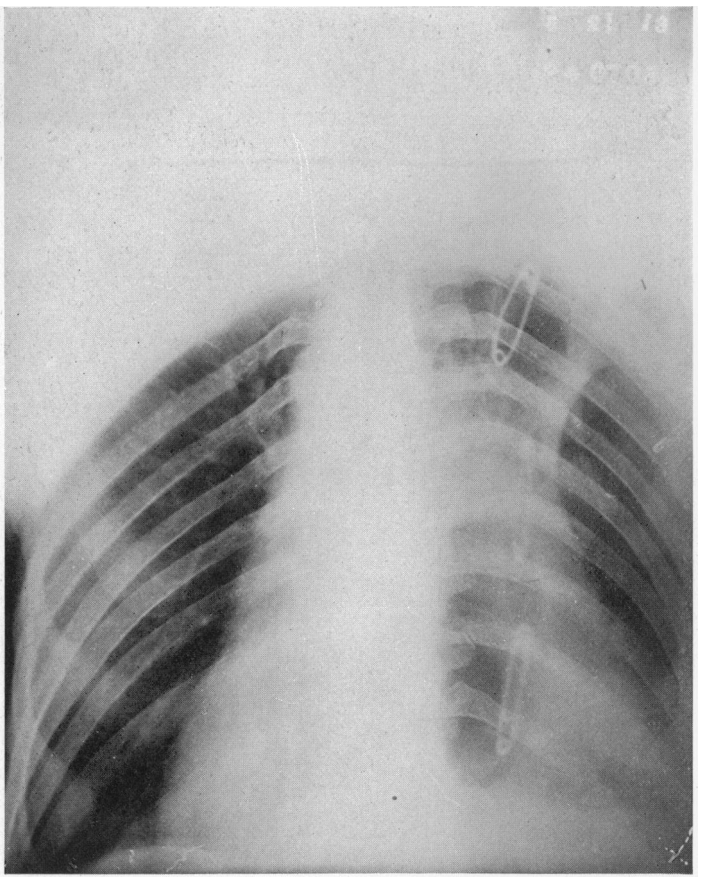

FIG. 4.—(240703) Röntgenogram made eighteen days after operation.

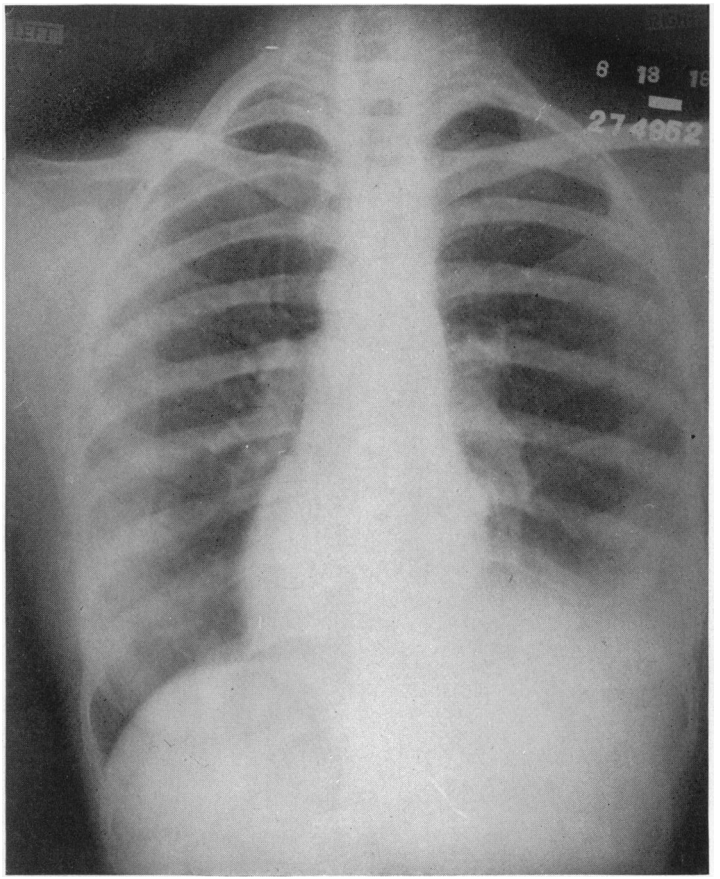

FIG. 5.—(281586) Röntgenogram made nine days before operation.

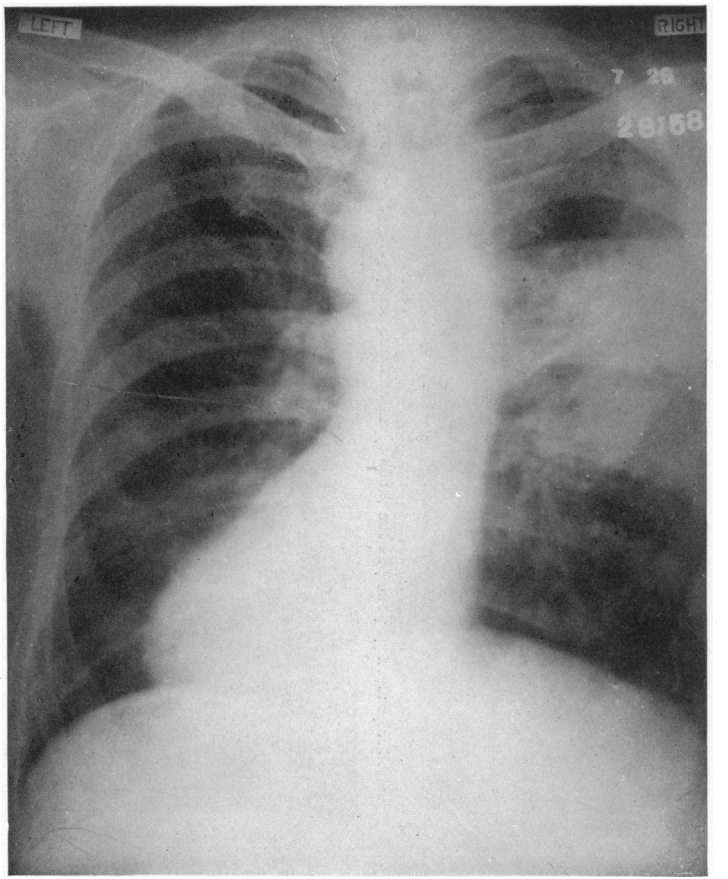

FIG. 6.—(274952) Röntgenogram made two days before expelling tooth.

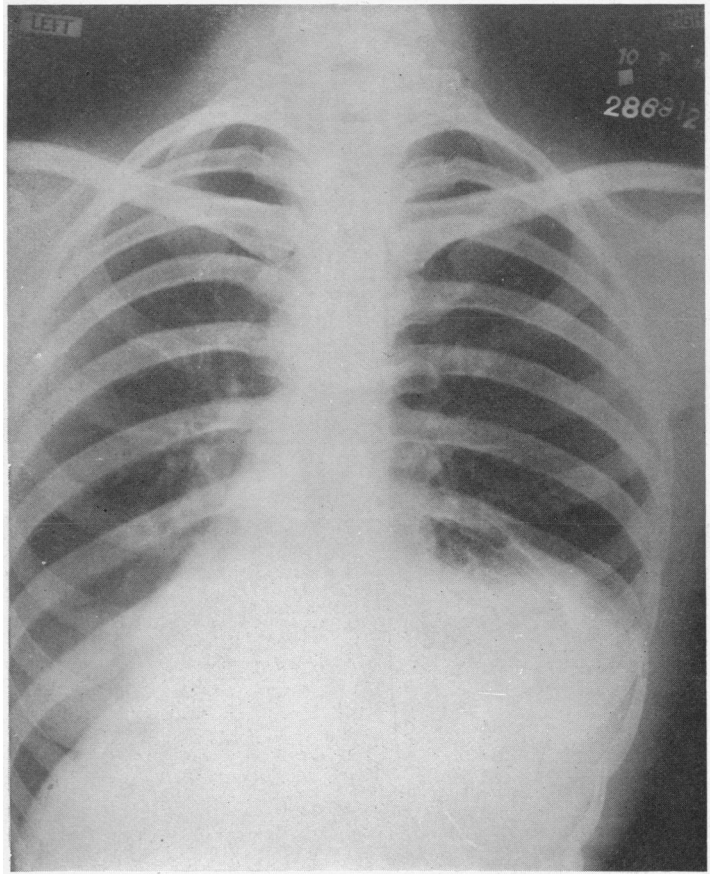

FIG. 7.—(286912) Röntgenogram made about one and one-half years after patient expelled two pieces of teeth and silver filling.

CASE I (169958).—E. R. F., aged thirty-four years, an anæmic, emaciated woman, came to the clinic August 21, 1916, complaining of cough with sputum, pain in the back, fever, weakness, and loss of weight.

The illness began in January, 1915, following teeth extraction under general anæsthesia. The patient began to cough immediately on awakening from the anæsthesia and the cough had persisted. Pulmonary tuberculosis was diagnosed for which she was treated for a number of months. September, 1915, an X-ray was taken and a tooth was revealed in the lower part of the right lung. Three attempts were made to remove the tooth by bronchoscopy but all failed. Thoracotomy was then done, but the tooth was not found.

When the patient came to the clinic her cough was very severe and persistent, preventing sleep. Pain in the back with fever had started six weeks before. She had lost 30 pounds in weight. The sputum was fœtid, greenish, and amounted to upward of a pint in twenty-four hours.

At the time of examination the hæmoglobin was 76 per cent., the leucocyte count 17,600, the systolic blood-pressure 117, the diastolic 60, the pulse 96, and the temperature 100.5°. Resonance was impaired and breath sounds were diminished at both bases. There was a scar of thoracotomy below the angle of the right scapula. The skiagram showed shadows at both bases which were believed to be due to the thickened pleura at the right and a small amount of fluid at the left base. The appearance of the right lower lobe suggested tuberculosis. The clinical diagnosis was old abscess of the right lung, and left pleurisy with effusion. August 25th a bronchoscopic examination was made. The tooth was not found, but much pus was seen coming from the right bronchus. Thoracentesis of the left pleural cavity yielded pus. August 28th a first-stage operation was done for drainage of the abscess. The patient died, however, before the second-stage drainage operation could be performed.

Necropsy showed a bilateral bronchiectasis and left empyema. The broken tooth, surrounded by an abscess, was found lying within 2.5 cm. of the lower surface near the lateral aspect of the lung (Figs. 1 and 2).

CASE II (216141).—J. R., a man aged sixty-six years, came for examination December 8, 1917. This patient appeared older than his years, probably due, in part, to exposure and to alcoholic excess. His illness began in October, 1917, after teeth extraction under ether anæsthesia. A number of teeth were broken off, and considerable bleeding followed for two weeks. Immediately after the operation the patient developed a constant dull pain in the right lower chest anteriorly. These symptoms persisted for two weeks, when he suddenly vomited a pint of pus; coughing and a large amount of purulent sputum persisted, especially during the month before examination, and kept him awake a great deal at night.

Examination of the chest showed an area of flatness in the right axilla. The hæmoglobin was 50 per cent., and leucocyte count 13,000. The systolic blood-pressure was 140, the diastolic 66, the pulse 84,

and the temperature normal. Repeated sputum examinations were negative for tuberculosis bacilli. The skiagram showed dense infiltration in the upper portion of the right lobe with cavitation. The patient was a poor surgical risk and he was kept under observation in the hope that there might be some improvement. His symptoms instead of subsiding, however, became more aggravated. Four weeks later the skiagram showed marked extension of the purulent process; operation was therefore advised. The patient was transfused once before the operation by the sodium citrate method, receiving one-half litre of blood. A two-stage drainage operation under local anæsthesia was performed because of the absence of pleural adhesions. An abscess cavity the size of a large orange and containing a mass of gangrenous lung tissue was found. The patient's convalescence was rapid; four months after the operation he had gained 50 pounds in weight. He was dismissed from the clinic with a small sinus. Five months later a portion of a tooth was found in the dressings. The sinus then rapidly closed. In September, 1919, the wound was solid and there were no symptoms referable to the old pulmonary lesions.

CASE III (235649).—Mrs. N. F., aged thirty-nine years, presented herself at the Mayo Clinic June 18, 1918, complaining of persistent cough with purulent sputum and occasional hæmoptysis. Her illness began in August, 1917, following teeth extraction under ether. The day following the operation she coughed up 4 or 5 ounces of dark, clotted blood having a very foul odor. She continued to cough and to raise large amounts of pus and blood. She also developed pleurisy with effusion, for which a thoracotomy was performed in September, 1917, and a secondary operation for drainage in November.

The patient coughed frequently during the examination, raising a bloody purulent sputum having a very foul odor. There was dullness in the left axilla, moist râles, and tubular breathing toward the apex. The hæmoglobin was 80 per cent. and the leucocyte count was 9400. The systolic blood-pressure was 126, the diastolic 70, the pulse and temperature normal. There was distinct clubbing of the fingers. The sputum was repeatedly examined for tuberculous bacilli, but none were found. The skiagram showed infiltration of the lower left lobe of the lung, and a diagnosis of probable abscess was made. An exploratory aspiration was performed in the region of the thoracotomy incision. The first operation was interrupted by an epileptiform seizure followed by lapse of consciousness for about five minutes. Six days later a tubular cavity was opened and drained. The patient left the hospital two weeks later; the wound drained for some weeks and then closed. There have been no further symptoms.

CASE IV (240703).—J. K. S., a man aged forty-five years, came for examination August 1, 1918. He appeared to be very sick and complained of cough with much foul sputum. He had had several teeth extracted in May, 1918. Two weeks later he began to cough, raising

foul-smelling sputum, sometimes 24 ounces each day. Slight swelling of the legs had been noted.

The physical examination disclosed marked loss of weight, foul breath, systolic blood-pressure 110, diastolic 60, pulse 80, and temperature 98°. The right chest wall was markedly retracted and there was an area of dullness about the level of the second and third ribs anteriorly. Breath sounds in this region were intensified. No tuberculosis bacilli were found in the sputum. The skiagram showed marked infiltration in the upper right lobe which was diagnosed abscess with cavitation. The fluoroscopic examination revealed a fluid level with distinct splashing.

A two-stage operation was performed for drainage of the abscess, which was found to lie about in the midaxillary line. The abscess contained little pus, but some very foul-smelling necrotic tissus was removed. The convalescence was slow, although progressive, and the patient left the hospital with a bronchial fistula. January 19, 1919, the patient reported by letter that he had gained 38 pounds in weight, that the fistula had closed, and that there were no symptoms referable to his former illness (Figs. 3 and 4).

CASE V (281586).—J. A. C., a rather frail looking man, aged sixty-three years, came to the clinic July 23, 1919, complaining of cough with sputum, weakness, and loss of weight. His illness began in October, 1918, when he was kicked in the face by a horse. The kick was a glancing blow, breaking the bridge of the nose and knocking out several teeth. He was knocked unconscious by the blow. There was some cough immediately on recovering consciousness, and the patient believes that he must have swallowed a great deal of blood, because his stools were black following the accident. Eight weeks later a corrective operation under cocaine was done on his nose. He then had a mild attack of pneumonia; he was in the hospital for four weeks, and had several attacks of hæmoptysis. One month after recovering from pneumonia he developed severe pain in the right chest with fever running up to 103°. Twenty-four hours after the onset of this illness the "abscess broke," and a pint of pus was coughed up. There has since been a persistent cough with sputum, amounting to about a teacupful in twenty-four hours, progressive weakness, and a weight loss of between 20 and 30 pounds (Fig. 5).

Slight dullness was found at the right apex anteriorly, with marked amphoric breathing. The respiratory excursion at the right apex was lagging. Many teeth were missing, and those remaining showed marked pyorrhœa and some were carious. The hæmoglobin was 58 per cent., and the leucocyte count 16,000. The systolic blood-pressure was 134, the diastolic 84, the pulse 88, and the temperature 101°. Sputum examination for tuberculosis bacilli and elastic tissue was negative. The skiagram showed a large abscess in the upper lobe of the right lung. The clinical diagnosis was probable aspiration abscess. A two-stage drainage operation was performed as pleural adhesions could not be definitely made out. A deeply situated abscess about 3 inches in diameter was opened and drained. The

convalescence was uneventful and the patient went home three and one-half weeks following operation in good general condition. He had no cough or sputum at this time and had gained 15 pounds in weight.

CASE VI (274952).—Mrs. J. S., a thin, rather frail looking woman, aged thirty years, presented herself June 12, 1919, complaining of headache and pain in the abdomen which began following childbirth January, 1919. In May, 1919, the patient was given ether for teeth extraction. She began to cough immediately on awakening from the anæsthesia. The cough, paroxysmal in character and worse at night, continued and was accompanied by more or less pain in the lower substernal region. The expectoration was mostly foamy mucus and moderate in amount. Perspiration was profuse at night; vomiting was frequent.

The patient was a poorly developed woman with marked evidence of loss of weight. At the time of examination the hæmoglobin was 64 per cent., and the leucocyte count 9000. All the teeth were missing. There were râles and increased breath sounds at the right apex. The right base was dull to percussion. The sputum was negative for tuberculosis bacilli. The X-ray examination showed pleural thickening with probable fluid at the right base. The diagnosis was that of general debility with probable slight right pleural effusion. The question of the presence of a foreign body was raised, but there was no definite evidence, and the patient was discharged without surgical treatment. June 15, 1919, during a very severe paroxysm of coughing she expelled a tooth. The cough and expectoration immediately became somewhat less, but at the last report, August 7, 1919, she still had pain in her back and some cough (Fig. 6).

CASE VII (286912).—Mrs. A. K., aged thirty-three years, presented herself September 1, 1919, complaining of a cough with purulent sputum, weakness, and loss of weight. The onset of her illness dated back nineteen months, following extraction of many teeth under general anæsthesia. She began to cough immediately on awakening from the anæsthesia; the cough persisted. Six weeks after the teeth extraction she coughed up two pieces of tooth, and twelve weeks later a silver filling. The cough, however, continued; the sputum was foul and amounted to a cupful in twenty-four hours. She had pain in the right chest, night sweats, and occasional hæmoptysis. The symptoms instead of subsiding after the foreign body was expelled became progressively worse.

At the time of examination the patient was sitting with a basin before her, coughing more or less continuously, and raising very foul purulent sputum. The systolic blood-pressure was 100, the diastolic 60, the pulse 72, the hæmoglobin 80 per cent., and the leucocyte count 5000. The sputum examination was negative for tuberculosis bacilli. The skiagram showed a questionable shadow just behind the heart at the cardiophrenic angle. Because of the incessant cough and large amount of sputum, it seemed advisable to do an exploratory operation notwithstanding the meagre X-ray and physical find-

CASES WITH COMPLICATIONS

Author	Age Sex	Foreign body	Location	Nature of accident	Anæsthesia	Immediate symptoms	Late symptoms	X-ray	Latent period	Spontaneous expulsion	Treatment	Results	Postmortem	Remarks
Abercrombie...	? F	Artificial tooth	Not stated	Aspiration of loose artificial tooth	Not stated	Cough, dyspnœa, pain	Cough with purulent sputum; pain in chest	None	Not stated	Two years seven months after accident	Not stated	Seven months later recurrence of symptoms suggesting an abscess; died	.....	Died 9 months after expelling tooth.
Carpenter.....	35 M	Four false teeth on silver clamp	Right pleural cavity	Swallowed tooth in a fit of coughing. Took catharsis. Incident then forgotten	None	None	First 11½ years; occasional attacks of shortness of breath; fever; pain in chest; cough; dullness in right chest	None	11½ years	No	Symptomatic	Died 13 years after accident	Fistula of lung opened into large empyema cavity containing pus. Lung collapsed. Denture with 4 teeth found in the pleural cavity. Left lung tubercular.	
Kappesser.....	20 F	Molar tooth	Left bronchus	Teeth extracted	N_2O	Spasmodic cough. Pain in chest	Cough; purulent sputum; fever; hæmoptysis; pain in chest; nausea; distant breathing	None	None	One month after accident	Symptomatic	One month after accident coughed up half a molar tooth; died the same day	Ulcerating right bronchus apparently the site of tooth. Abscess at the base of lung; probably tuberculosis.	
Chambers.....	35 F	Tooth	Left bronchus	Thirteen teeth extracted	N_2O	Fainted on recovering from anesthesia. Cough dyspnœa, nausea, prostration	Dyspnœa; nausea; cough; mucopurulent sputum; fever; signs of consolidation in left chest	None	None	Six days after accident	None	Complete recovery	.....	All symptoms disappeared in five weeks
Israël.....	26 M	Fragment of tooth	Left lower lobe	Not stated	None	Not stated	Pain in left chest; purulent sputum; sinuses and retraction of chest wall. Marked emaciation. Pus contained actinomycotic rosettes	None	None	None	No surgical treatment	Died one and one-half years after onset of symptoms	Cavitation in left lung; fragment of tooth in pleural cavity	Patient, a hostler, drank out of same trough as his horse.
Wigg.....	30 F	Tooth	Right bronchus	Tooth slipped from forceps during extraction of teeth	Ether	Slight cough	Violent cough; purulent sputum; hæmoptysis; fever; pain in chest; dullness in right base	Negative	Fourth day	None	Thoracotomy performed to facilitate expulsion	Died three and one-half weeks after accident	Large empty empyema; small abscess in middle lower lobe; bicuspid tightly impacted.	
Verco.....	27 F	Tooth	Right bronchus	Teeth extracted	N_2O	Severe cough, profuse perspiration, fever, pain in chest. Tasted and smelled tooth	Cough; fetid sputum; fever; dullness in right base	None	None	Twelve weeks after accident	Symptomatic	No record	.....	About 12 weeks after the accident coughed up the tooth.
Verco.....	39 F	Tooth	Right bronchus	Teeth extracted	N_2O	Severe cough with sputum having odor and taste of bad teeth	Cough; fetid sputum; fever	None	Two months	Three weeks after accident	Symptomatic	Died from suffocation following sudden bursting of abscess	.....	Abscess burst 2 months after tooth extraction.
MacCormac....	24 F	Blade of forceps	Right bronchus	Teeth extracted; forceps broke	Chloroform	Violent spasmodic cough, extreme cyanosis, severe pain in chest	Cough; dyspnœa; pain in right chest. Harsh respiratory stridor, râles right base	None	None	No	Tracheotomy, instrumental removal	Complete recovery	.....	Great difficulty experienced in getting hold on blade.
Himmelsbach...	21 F	Tooth	Left bronchus	Five teeth extracted	N_2O	Periodic dyspnœa, violent cough and wheezing	Cough, sputum, hæmoptysis. Signs of bronchitis	Not stated	None	Four and one-half months after accident	None	Complete recovery	.....	Coughed up tooth with cotton pack in cavity; immediate relief of symptoms.
Warrack.....	26 F	Tooth	Left bronchus	Teeth extracted	N_2O	Extreme cyanosis, tightness of throat, dyspnœa, hard, dry, paroxysmal cough, wheezy respiration. No breath sounds	Hectic temperatures, 13th day offensive breath, brown, foul smelling sputum, cough	Not stated	None	No	None	Died 16 days after accident	Complete obstruction of left main bronchus. Whole lung gangrenous; crowned bicuspid tooth wedged into bronchus; ball valve obstruction.	
Arnold.....	23 F	Artificial tooth with plate	Lower right bronchus	While eating	None	Extreme dyspnœa; spasmodic cough	Slight cough, mucoid sputum, transient râles, right chest	Tooth localized by triangulation	Two months	Two months after accident	Thoracotomy. Operation twice interrupted on account of hemorrhage. Foreign body loosened	Foreign body coughed up after operation. Complete recovery	.....	One of the early instances of X-ray localization.
Godlee.....	47 M	Molar tooth	Lower right bronchus	Not stated	None	After 10 minutes extreme dyspnœa. Slight pain in right chest	Spasmodic cough; purulent sputum; hæmoptysis; sudden pain; emaciation; signs of abscess	None	None	No	Drainage of abscess; no foreign body found	Died 14 months after accident	Advanced bilateral tuberculosis; cavity of right apex, tuberculosis of cæcum; bilateral lower lobe; bronchiectasis; tooth in lower right lobe of bronchus.	
Strange.....	23 F	Part of tooth	Right bronchus	Unsuccessful attempt at teeth extraction. Part of tooth loosened	Not stated	Not stated	Symptoms of gangrenous abscess	Not stated	Not stated	No	Thoracotomy for drainage of abscess; tooth not found	Complete recovery.		
Dickson.....	28 M	Stump of upper molar	Left bronchus	Twelve stumps of teeth extracted	N_2O	Cough with slight uneasiness behind the sternum; no pain	Influenza with severe cough and slight purulent sputum after a few weeks. Transient aphonia after 3 weeks of dry pleurisy, persistent cough	None	Three weeks	Thirteen and one-half months after accident	Symptomatic	Sudden recurring hæmoptysis; coughed up tooth; recovery.	.....	Diagnosed tuberculosis by several consultants.
Külbs.....	48 M	Piece of carious tooth	Right upper lobe	Not stated	Not stated	Not stated	Four hundred c.c. of foul sputum containing elastic tissue fibres; signs of cavity; duration of symptoms three months	Not stated	Not stated	No	Thoracotomy for drainage of lung abscess	Marked improvement; small fistula 2 months after operation.		
Monro.....	10 M	Tooth	Left bronchus	Loose tooth probably aspirated. Operation for tuberculosis of knee, under ether	Ether	None	Cough and fever on 4th day, râles; loss of vocal fremitus; offensive sputum 14th day	Not stated	No	No	Symptomatic	Died 16th day after accident	Entire lung gangrenous.	
Smith.....	? M	Burr	Left upper lobe	Drilling back upper molar	No	None; went to board meeting	None	Burr in left upper lobe	Yes	No	Four bronchoscopies failed. Partial pneumonectomy	Patient died from operation; burr obtained	.....	Dr. Jackson thought it too far out for bronchoscopy.
Freidberg.....	24 F	Tooth	Right bronchus	Extraction of 10 teeth	Ether	Cough; pain in right side	Increased cough; foul sputum; fever; pain in chest; loss of weight	Tooth	Not stated	No	Foreign body removed by upper bronchoscopy under ether 9 weeks after accident	Expectoration and cough continued for several months; further history unknown.		
Thomson.....	10 F	Tooth	Left bronchus	Inhaled from towel on waking up after anæsthesia	N_2O	Wheezy respiration. Physical examination after several days; very little air entering lung	After 2 months fever and other symptoms of abscess	Tooth; limited movement of diaphragm. Later X-ray showed opacity of lung	Two months	No	Two unsuccessful bronchoscopies before abscess formation; tracheotomy; lower bronchoscopy; foreign body removed 2 months after accident	Complete recovery	.....	Small abscess cavity behind tooth; pus released on pulling tooth from bronchus.
Morrison.....	36 F	Tooth	Left bronchus	Six to 8 teeth extracted	Chloroform	Dyspnœa; tightness in chest; said stump of tooth had gone down in throat	After 3 weeks, cough; fever; hæmoptysis; profuse, fetid sputum; loss of weight and strength	Negative	Three weeks	No	Thoracotomy; resection of large part of lower lobe of lung	Died of pericarditis on 28th day after operation	Pericarditis; tooth stump impacted in bronchus; missed in resection by ¾ inch	Diagnosis of bronchiectasis from foreign body was made only after 2 years of symptoms.
Brauch.....	22 F	Premolar tooth	Not stated	Teeth extracted	Chloroform	Slight dyspnœa	Lung abscess	Not stated	Two years	Yes	None	Much bloody, foul sputum; serious collapse but ultimate recovery.		
Getchell.....	24 F	Root of tooth	Lesions in both bases, most marked on left	Extraction of several teeth	Ether	Indefinite left pleurisy ?	Pain; cough; foul sputum; intermittent fever; hæmoptysis; pneumonia	Not stated	Two weeks	Two weeks after accident	Drainage of lung abscess	Recovery	.....	Recurrence of abscess ?
Getchell.....	16 F	Tooth	Right bronchus	Six teeth extracted	N_2O	"Ailing"	After 3½ months "Typhoid bronchitis" in bed from 3 to 4 weeks; breath offensive; cough; foul sputum	Negative	Three and one-half months	One year after accident	Postural treatment; much improvement	Not known.		
Hubbard.....	.....	Tooth	.....	Dental operation	.....	Not stated	Chronic cough; purulent sputum	.....	.....	.....	None	Spontaneous recovery after several years	.....	Not very ill at any time.
Hubbard.....	34 F	Disc of Allen's dental cement. 7 x 9 mm.	Left lower lobe of bronchus	Extraction of 22 teeth	Ether	Cough almost continuous during waking hours	Fever; cough; foul muco-purulent sputum; emaciation; tuberculosis diagnosed	Negative	None	No	Bronchoscopic; removal 7th month	Perfect recovery; gain in weight 34 pounds.		
Hubbard.....	.....	Tooth	.....	Dental operation	.....	Not stated	Chronic cough; purulent sputum	.....	.....	.....	None	Spontaneous recovery after several months.		
Robinson..... (Mayo Clinic)	34 F	Tooth	Right lower lobe	Teeth extracted	Ether	Cough; sputum; pain in back	Cough; pint foul sputum in 24 hours; pain in chest; fever; emaciation	Tuberculosis of right base? No foreign body	Eight months	No	Bronchoscopy; pus in right bronchus; aspirating left pleural cavity pus; first stage operation, drainage, abscess of left lung	Died shortly after thoracotomy operation	Bilateral bronchiectasis; left empyema; tooth in lower lobe of right lung	Tooth within 2.5 cm. of inferior surface of lower lobe.
Barker.....	?	Tooth	Right bronchus	Not stated	Not stated	Not stated	Not stated	Not stated	Not stated	No	Thoracotomy for removal of foreign body	Died while being chloroformed for operation	.....	Gangrene and empyema; postmortem (?)
Pirie.....	? M	Tooth	.....	Extraction of several teeth	Not stated	Not stated	Bloody expectoration; chills; pain left side; duration, 6 days	Negative	Not stated	No	Thoracotomy for drainage	Complete recovery	.....	X-ray showed fluid level in abscess cavity.
Forbes.....	39 F	Tooth and bone	Left bronchus	Several teeth extracted	General	None for several weeks	Constant cough; profuse purulent sputum; loss of weight 68 pounds	First plate negative for tooth; abscess of left upper lobe. Later X-ray positive	Few weeks	Piece of bone and tooth	Eleven bronchoscopies; suction to abscess cavity; injection of argyrol	Not stated	.....	Foreign body not suspected until patient coughed up piece of bone 5 weeks before admission to hospital.
Hedblom..... (Mayo Clinic)	66 M	Tooth	Right upper lobe of bronchus	Many teeth extracted	Ether	Dull pain in lower right chest; bled considerably; cough; sputum with foul odor	Dull pain; cough and sputum for 4 weeks after teeth extracted; chills; sudden expectoration of pint of foul pus	Abscess of right upper lobe; no foreign body	None	No	Thoracotomy for drainage of lung abscess	Complete recovery	.....	Tooth discharge through wound 5th month after operation.
Hedblom..... (Mayo Clinic)	39 F	Tooth ?	Left lower lobe	Teeth extracted	Ether	Cough	Moist râles; tuberculous breathing; clubbing of fingers; hæmoptysis; chronic cough and foul sputum	Infiltration of lower left lobe of lung probably abscess	None	No	Thoracotomy for drainage of lung abscess	Complete recovery.		
Hedblom..... Mayo Clinic)	45 M	Tooth ?	Not stated	26 teeth extracted	Ether	None	Cough; foul sputum; fever; dullness of right chest	Abscess of right upper lobe	Two weeks	No	Thoracotomy for drainage of gangrenous lung abscess	Complete recovery.		
Hedblom..... (Mayo Clinic)	63 M	Tooth ?	Not stated	Kicked by horse	Cocain	Cough for 24 hours; tarry stools	Eight weeks after accident pneumonia, then hæmoptysis, purulent sputum, pain in chest, fever, loss of weight; abscess broke	Large abscess in upper right lobe	Eight weeks	No	Thoracotomy for drainage of lung abscess	Complete recovery.		
Hedblom..... (Mayo Clinic)	33 F	Two teeth and silver filling	Right lower lobe	Teeth extracted	Ether	Cough	Cough and purulent sputum, 1 cupful each day	Negative	None	Two pieces of tooth in 6 weeks, filling 12 weeks.	Thoracotomy for drainage of lung abscess. First stage operation	Uncertain.		

CASES WITHOUT COMPLICATIONS

Author	Age Sex	Foreign body	Location	Nature of accident	Anæsthesia	Immediate symptoms	X-ray	Latent period	Spontaneous expulsion	Treatment	Result	Postmortem	Remarks
Medicolegal reports...	.....	Porcelain tooth	Right bronchus	Not stated	Not stated	Not stated	Not stated	Not stated	After 3 years	None	Not stated	.....	Verdict for plaintiff; damages 750 pounds.
Jackson.....	13 ?	Molar tooth	Right inferior bronchus	Not stated	Not stated	Not stated	Not stated	None	No	Bronchoscopic removal	Died with typhoid fever 10 days later	.....	Tooth impacted. Widal test positive on admission.
Jackson.....	14 ?	Molar tooth	Right upper bronchus	Not stated	Not stated	Not stated	Not stated	Not stated	No	Bronchoscopic removal	.....	.....	Tooth difficult to find.
Jackson.....	39 M	Root canal broach	Small posterior branch of a larger posterior root branch of inferior bronchus	Not stated	Not stated	Not stated	Broach just above dome of diaphragm	Not stated	No	Bronchoscopic removal	Not stated	.....	Lowest position by which a foreign body has been removed by bronchoscopy (Jackson).
Shurly	.....	Tooth ?	Not stated	Teeth extracted	N_2O	Cough	Tooth	None	No	Tracheotomy; bronchoscopy	Foreign body removed; recovery.		
Shurly.....	? F	Hard rubber from dental mouth gag	Not stated	Teeth extracted	N_2O	Cough, odor of rubber, air to lower lung cut off	Not stated	None	No	Bronchoscopic removal	Not stated	.....	Foreign body slipped back into trachea; coughed up.
Shurly.....	49 M	Dental burr	Lower left bronchus	Drilling of teeth	No	Not stated	Shadow of metallic body	Not stated	No	Bronchoscopic removal about 10 days after accident	Complete recovery.		
Munger.....	.....	Dental burr	Trachea	Not stated	Not stated	Not stated	Foreign body	None	No	Tracheotomy; burr not found	Recovery	.....	Burr probably coughed up into nasopharynx during tracheotomy anesthesia. Spat out next day.
Freidberg	35 M	Three teeth bridge	Left bronchus	Aspiration during intoxication sleep	Alcohol intoxication	Cough, moderate dyspnœa, soreness on pressure	Bridge	Not stated	No	Fluoroscopic bronchoscopy; foreign body removed	Complete recovery	.....	Ordinary bronchoscopy failed on account of hemorrhage from lung.
Freidberg.....	46 M	Dental broach	Left main bronchus	Dental operation	Not stated	Paroxysmal cough; soreness	Not stated	Not stated	Three days after accident	Bronchoscopy postponed on account of alveolar abscess; jaws could not be opened	Recovery	.....	Symptoms not severe enough to warrant low bronchoscopy. Two or three days later broach coughed up.
Lynch.....	? F	Plaster of Paris	Both lungs	Making cast of mouth	None	Persistent, spasmodic cough	Not stated	Five years	No	Bronchoscopic removal of plaster of Paris from lungs	Complete recovery; gained 30 pounds in weight	.....	Constricted bronchials dilated.
Mayer.....	.....	Gold crown of wisdom tooth	Not stated	Not stated	Not stated	Not stated	Not stated	Not stated	No	Bronchoscopic removal	Not stated.		
Fowler.....	.....	Teeth	Lower left bronchus	Not stated	Not stated	Not stated	Not stated	Not stated	No	Thoracotomy failed	Patient died later	Tooth found impacted in a secondary bronchus.	
Jarvis.....	50 M	Tooth and crown	Left bronchus	Extraction of lower left wisdom tooth	N_2O	Dyspnœa, cough; great prostration; fever; sibilant râles; slight sputum	None	No	Five days after accident	None	Recovery	.....	Tooth and crown expelled in violent paroxysm of coughing with hæmoptysis.
Murphy.....	30 F	Porcelain tooth	Right lower bronchus	Tooth slipped from dental forceps	Not stated	Not stated	Tooth	.....	.....	Two unsuccessful high bronchoscopies; tracheotomy low; bronchoscopic removal	.....	.....	Tooth very firmly impacted; never any symptoms.
Hedblom..... (Mayo Clinic)	30 F	Teeth	Right bronchus ?	Extraction several teeth	Ether	Paroxysmal cough, substernal pain on right; sweating; frequent vomiting; râles; increased breath sounds	Pleural thickening; fluid right base	No	About 3 months after accident	None	Recovery	.....	Very little cough and sputum four months after expulsion of tooth.

ings. September 6, 1919, a first-stage operation was done for drainage of the abscess. Portions of the ninth, tenth, and eleventh ribs were resected, and the lung was sutured to the parietal pleura. Pneumothorax had not occurred so far as could be ascertained. A week later an exploratory aspiration was performed for abscess. The aspiration yielded only air which was entirely without odor. Following this negative aspiration the patient began to improve, the cough and sputum practically ceased within a week, and the patient began to gain in weight. It seemed probable that a local pneumothorax had been produced which was sufficient to bring about the good results. A letter from the patient's family physician October 17th stated that she was in excellent condition, but October 30th a second letter was received stating that there was a recurrence of the cough and sputum (Fig. 7).

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