

LUDWIG'S ANGINA.

REPORT OF FIVE CASES INCLUDING ONE AUTOPSY.*

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IN the year of 1836, Dr. Ludwig of Stuttgart, described an acute septic inflammation of the submaxillary region, accompanied by a hard sublingual swelling, together with the symptomatology. This condition has been designated Ludwig's angina. Dr. Thomas has recently collected 106 cases in the literature including two of his own with a mortality of 40.3 per cent. I take this opportunity to express my indebtedness to this comprehensive article by Dr. Thomas for many of the references in my own paper. Probably many cases have occurred which have not been recorded. That it sometimes occurs in groups has been observed by F. Murchison, Klein, Seymour-Taylor and G. G. Davis. The latter says that five of his cases came from the same section of the city in a period of five weeks.

The five cases which I am reporting were admitted to the Episcopal Hospital, Philadelphia, between March 1 and May 12 of this year. Although two of them developed in the same ward of the hospital, I do not regard the condition contagious.

1. *The Infecting Organism.*—No specific organism has been found for Ludwig's angina. Dr. Thomas searched the literature and found eighteen cases reporting the bacteriological findings as follows:

The streptococcus was found alone in six cases. The streptococcus associated with other organisms, staphylococcus and diplococci in eight; the staphylococcus alone in two; the pneumococcus alone in one and an undetermined bacillus in one.

* Read before the Philadelphia Academy of Surgery, June 1, 1908.

In my cases the following organisms were found:

CASE I.—Cultures and smears show mixed bacteria flora.

CASE II.—Cultures and smears show mixed bacteria flora—Staphylococcus, micrococcus salivarius—Biondi; Streptococcus capelletti.

CASE III.—Micrococcus salivarius—Biondi.

CASE IV.—Micrococcus salivarius—Biondi.

CASE V.—Cultures from incision show Bact. ferrugineum. (Dyal); by aspiration, large diplococcus, small diplococcus, long, thin bacillus, streptobacillus (strepto-diplo-bacillus?).

2. *The Primary Focus of Infection.*—The most common primary focus of infection is dental caries. Dr. Davis reported one case in which the inflammation was started by a dentist injecting a solution of cocaine around a carious tooth and extracting it. Two of the cases now reported started in this manner. After cocaine had been injected in the gums and the tooth extracted, Case IV developed a submaxillary swelling in 48 hours and Case V developed a submaxillary swelling in 24 hours. Case III had carious teeth and a submaxillary swelling of a month's standing but a sudden enlargement of this swelling developed in four to eight hours after a dentist had pulled a tooth. Other foci that have been mentioned are wounds of the mucous membrane, otitis media, peritonsillar abscess. C. J. Aldrich reports a case that started from the tonsil and W. A. Humphrey describes a case preceded by tonsillitis.

One of the present patients (Case I) had an attack of tonsillitis with a temperature 103 which gradually subsided to normal in five days, but six days later the patient developed Ludwig's angina. Case II complained of sore throat and examination showed redness of the pharynx; the next day the patient had developed Ludwig's angina and in 55 hours he was dead.

3. *The Mode of Transmission of the Infection.*—If the primary focus is in the tooth as in Case III, IV and V, I agree with Dr. Davis that the inflammation involves the periosteum of the lower jaw and thence invades all the surrounding tissues

by direct contiguity. But if the primary focus is the pharynx (Case II) or the tonsil (Case I) or some other point distant from the submaxillary region, it is probable that the infection was carried by the lymphatics. It is possible there is transmission of the infection from the mouth by the ducts of the sublingual gland which show marked inflammatory cellulitis in the sections from Case II.

Regardless of the seat of the primary focus, the secondary infection in these cases is in the submaxillary region; the floor of the mouth; and the following muscles: digastric, stylohyoid, mylohyoid, geniolyoid, geniohyoglossus, hyoglossus, chondroglossus, styloglossus, palatoglossus, sternohyoid, sternothyroid, thyrohyoid, omohyoid.

The connecting tissues and overlying subcutaneous tissue are also affected. The pharynx and larynx become rapidly involved. In a fatal case, as in Case II, the entire trachea may be invaded. The cellular infiltration travels by the lymphatic spaces and by contiguity.

The clinical picture of the condition given by Ludwig was that of a fatal case.

The following are the symptoms of the early and less severe types:

Constitutional.—There is early fever, temperature 99 to 103, headache, malaise, loss of appetite and insomnia.

Local.—Increase in the secretion of saliva which is of a thick ropy character. If there is an opening into the mouth there is a profuse mucopurulent discharge together with the saliva which may amount to as much as sixteen ounces in twenty-four hours. Soon the patient notices a submaxillary swelling of a shoe-leather resistance which is painful. There is also tenderness which may be marked or slight. Then there is rapid œdema of the sublingual tissues and swelling of the face as far up as the malar bone and swelling of the neck down to the clavicle. The larynx and pharynx are rapidly affected and there is difficulty in opening the mouth, in swallowing, talking and breathing.

Treatment.—As soon as the diagnosis is made, use local

anæsthesia (ethyl chloride) and make incisions over the submaxillary triangles through the mylohyoid muscles and if there is severe swelling also through the median line between the hyoid bone and the symphysis to the mucous membrane. Use rubber drainage-tubes through and through the lateral incisions.

If the sublingual tissue is markedly œdematous, incise the mucous membrane from the midline to the second molar tooth and then insert a curette and curette wherever there is a feeling of the tissues giving way. There is usually a profuse discharge of blood which clots immediately. There will then be a profuse mucopurulent discharge of a very foul odor and bad taste. The relief is instant. You can actually see the sublingual œdema subside, and the patient will tell you that he can talk better and you will be able to notice the change in the voice.

Prognosis.—Dr. G. G. Davis reports mortality 40 per cent. in the cases under his own care. Thomas in his recent paper gives the mortality as 40.3 per cent. for all the cases reported.

Of the five cases now reported, one died and four recovered—mortality 20 per cent. The first of these patients was admitted to the Episcopal Hospital in the service of Dr. William T. Van Pelt and the other four in the service of Dr. Thomas R. Neilson with whose kind permission they are presented.

CASE I.—(Surgeon, Dr. William T. Van Pelt). J. T., age 29 years. Admitted December 24, 1907; suffering from interstitial keratitis. February 13, 1908, complained of sore throat, headache, backache and loss of appetite. 5.30 P.M. Examination: throat, pharynx and tonsils are red. 11.50 P.M., tonsils are slightly swollen and show a few follicles filled with pus. Treatment: H_2O_2 and $AgNO_3$ gr. lx to ʒi .

2-20-'08. Less pain in the throat. Tonsils are swollen and some crypts contain pus. Anterior cervical glands are enlarged.

2-23-'08. Very few crypts contain pus. Has no pain. Feels well. Temperature 98° .

2-29-'08, 9 A.M. Has complained all night of not sleeping and of pain in the throat. Difficulty in swallowing. Examinations show tonsils red and anterior cervical glands are enlarged and painful.

3-1-'08, 12.15 A.M. Complains of pain and swelling of floor of mouth and difficulty in talking and drinking. Cannot take food. Examination shows marked cellulitis of neck and the submaxillary region is very painful and tender to touch. Very hard. Difficulty in moving tongue and opening mouth. Marked oedema of floor of mouth and mucous membrane. Tongue is swollen. Increased saliva. Condition resembles Ludwig's angina.

Operation by Dr. Price:—Local anæsthesia—ethyl chloride. Three incisions are made. One in the median line below the chin and two lateral incisions into the submaxillary triangle. Blood and serum flowed freely. Subcutaneous tissue oedematous. A rubber drainage-tube is passed through and through the lateral incisions. Patient says he feels much better.

3-1-'08. P.M. Patient is doing nicely. Not so much submaxillary swelling.

3-2-'08 (1st day after operation). Dr. Davis examined patient and considered it Ludwig's angina. Dr. Davis passed a knife by median incision, through the floor of the mouth. Incisions are draining blood and serum. Patient feels better. He can get his mouth open more easily. Tongue is only slightly swollen.

3-3-'08 (2nd day). General condition is very much better. Not so much swelling. Patient is expectorating a foul, bloody mucopurulent sputum. The pharynx is not so congested. Incisions are draining bloody serum—no pus. *Tube removed.* Iodoform gauze inserted.

3-4-'08 (3rd day). Says he feels quite well. Tongue is normal. The lymphatics are markedly improved; only slightly enlarged. Feels like eating. Incisions are draining very little.

3-5-'08 (4th day). Doing splendidly. All symptoms have subsided. Temperature normal, 98.2°. The cornea is also much clearer than it has been.

3-15-'08. The incisions are granulating. Cultures and smears showed mixed bacteria flora.

4-8-'08. Discharged. The cornea is still cloudy and conjunctiva is slightly congested. Has no pain. Vision is fair.

CASE II.—(Surgeon, Dr. Neilson). W. T., age 80 years. Diagnosis: On admission, leg ulcer. Revised, complications, œdema of larynx, nephritis, myocarditis, arteriosclerosis, submaxillary adenitis, Ludwig's angina. Result: Died.

December 30, 1907. Patient was admitted to hospital for leg ulcer, size of silver dollar.

April 4, 1908. Complained of sore throat. Examinations showed redness of pharynx, especially on left side. Teeth are mostly missing, but there are several stumps or snags in bad condition.

On the next day there was difficulty in speaking. Examination showed œdema of sublingual tissue and slight cellulitis of submental region and submaxillary regions, especially the left.

Operation by Dr. Price: Multiple incisions made in mucous membrane beneath the sides of the tongue. Local condition not relieved.

By the following day, 8 P.M., sublingual œdema increased and patient does not talk so well. Has difficulty in breathing and swallowing and does not take food. An incision is made in the mucous membrane for one inch parallel to the alveolar margin along the base of the tongue on both sides. An incision is made in the median line into the sublingual tissue. These incisions seemed to relieve the patient at once of some of the œdema. He said he felt better and could talk more distinctly.

4-7-'08 (2nd day). Patient died at 6.45 A.M. It is said by the nurse that just before death he was talking to a patient in the next bed and that suddenly he fell over dead.

AUTOPSY.

Tongue.—Tissues of the mouth beneath the tongue seem to be swollen and œdematous; posterior part of the tongue is slightly swollen. Both tonsils are greatly enlarged, swollen, and on section in places show oozing of a small amount of thick creamy pus.

Pharynx.—Epiglottis greatly swollen and congested, reaching in places nearly half an inch in thickness. The larynx in the region of the vocal cords is greatly swollen and congested and œdematous, showing acute inflammatory œdema. The left side of the epiglottis and the larynx seem swollen more than the right.

Cultures were made from the larynx, from the tissues in the immediate vicinity of the larynx, and from the base of the tongue.

Smears from these regions were also made. The streptococcus capelletti and the *micrococcus solivarius*—Biondi were found.

Trocheo.—Showed marked swelling of the mucous membrane covered with a fibrinous mucopurulent exudate throughout.

MICROSCOPICAL SECTIONS

1. *Tonsil*.—Shows marked congestion, vessels are markedly dilated and filled with blood; the crypts are filled with plugs of granular debris containing bacteria. The peritonsillar tissue shows marked congestion and marked œdema and the perivascular spaces show large collections of leucocytes.

2. *Epiglottis*.—Section shows epithelial surfaces everywhere covered with much mucus, epithelial cells and leucocytes. Below epithelium the tissue is everywhere infiltrated with leucocytes, red corpuscles and inflammatory œdema. In some areas these collections of leucocytes, especially around the vessels, form distinct round abscesses. The vessels are everywhere markedly congested. This inflammatory œdema and exudation extends down to the cartilage.

Base of Tongue and Sublingual Gland.—The sublingual gland shows marked inflammatory cellulitis. The stroma is markedly infiltrated with leucocytes. These cellular infiltrations are so great that they press on the glandular tissue in many places to such an extent that the normal shape is lost. The tissues surrounding the gland contain considerable fat markedly infiltrated with large areas of leucocytic collections. These collections of leucocytes are so great that they form small pockets of pus.

The inflammatory infiltrations i. e., the leucocytic collections continue to the underlying muscular tissue and infiltrate the muscle fibres, separating them from one another. The intermuscular tissue in this area also shows considerable œdema and in some places there are to be seen small hemorrhages. All of the blood-vessels are congested.

Base of Tongue and Submaxillary Gland.—The submaxillary gland is apparently normal. The borders show slight inflammatory œdema and collections of leucocytes. The remainder of the section shows a similar condition described in section 3, i. e., inflammatory exudate, œdema, hemorrhages and pus. Sections 5 and 6 also taken from the base of the tongue at different points show the same conditions. These six sections have also been stained to show the presence of bacteria. In the infiltrated areas there are moderately large micrococci; a small diplococcus; a small diplococcus in chains. The study of sections with the microscope seems to show that the cellular infiltration has travelled by the lymphatic spaces and by contiguity.

Diagnosis.—Acute œdema of larynx secondary to a phlegmonous condition of the soft parts surrounding; marked interstitial nephritis; marked myocarditis with calcification of the larger vessels and sclerosis of the mitral and aortic valves and coronary vessels; old tuberculosis of the apices of both lungs; atrophy of liver with fatty change.

CASE III.—(Surgeon, Dr. Neilson). T. C., age 29 years. Diagnosis: On admission, submaxillary adenitis and sublingual cellulitis. Revised, Ludwig's angina. Result: Recovered.

Was admitted to hospital April 21, 1908.

Present Illness.—Began one month ago with a swelling beneath the right inferior maxilla. This was painless and hard and of very moderate size. For past three weeks he has had neuralgia of left upper part of face. One week ago he had the left canine tooth pulled. This relieved his neuralgia. A few hours later the submaxillary swelling had increased. Upon the following day he noticed sublingual oedema of right side only and swelling of right side of his tongue. This swelling rapidly increased so that on the morning of April 17, 1908, the tongue filled the posterior part of his mouth, touching the palate. On the left side of the tongue there was a small air-passage. He could breathe freely by the nose. Pain was due to pressure of tongue on the teeth. Speech was interfered with on account of inability to move his tongue freely. Says he was not hoarse. His breath was very foul. Saliva was increased to an enormous degree and was sticky and thick. Appetite was poor. He was able to swallow "milk and raw eggs," says that he would get this mixture in the anterior part of his mouth and then close the mouth and push the tongue forward like a wedge and thus force the mixture into the throat and swallow it. Temperature was not taken before 4-18-'08, and he does not know the degree. He slept in a sitting posture and the saliva would run from his mouth. His attending physician cut into the sublingual tissue but found only blood.

When admitted to hospital, April 21, his temperature was 100°; pulse, 72; respiration, 24. Fairly well nourished man who appears to be under tone. Face is drawn and cheeks are hollow. Pupils react. Tongue is coated gray throughout. It is swollen, especially on the right side, and posteriorly it touched the roof of the mouth. Speech is thick. Sublingual tissues are moderately oedematous on the right side only from the midline posteriorly and are higher than the cutting edges of the teeth. A small gray membrane to the right of the midline of the sublingual tissues marks the point of the attending physician's incision. Right first molar is carious and other teeth contain cavities. In the right submaxillary region there is a hard swelling slightly

nodular extending from the midline to the angle of the jaw. This swelling is not very prominent. Heart and lungs are normal.

11.30 A.M. He says that he expectorated three large masses of yellow-greenish mucopurulent material of very bad odor and taste one after another. These seemed to come from behind his tongue. He began to rapidly improve. Swelling of tongue decreased and he is able to speak more clearly.

3.30 P.M. Examination shows no discharging point, although the sputum cup is full of mucopurulent material and thin watery matter. This has a bad rotten taste.

5.30 P.M. Operation by Dr. Price: sublingual tissue is still œdematous and an incision is made into it, starting at the midline and going back to the last molar tooth. A eurette is inserted (1½ in.) and used thoroughly. A great deal of blood that clots instantly is removed, also small bits of caseous material—possibly glandular. A small amount of light greenish mucopurulent material is seen. This seemed to come from near the midline. The eurretting caused little pain. Pressure on the outside did not increase the flow. Cultures from incision showed "*micrococcus salivarius*—Biondi." *

During the day thereafter, sublingual œdema and swelling of tongue became very much less. General condition very satisfactory.

By the third day the tongue was normal. Sublingual œdema slight.

Steady improvement thereafter; patient was discharged on the ninth day.

CASE IV.—(Surgeon, Dr. Neilson). J. D., age 22. April 24, 1908, a dentist injected cocaine around the first right molar in the lower jaw and extracted the tooth. Two days later he noticed a very hard painful swelling below the right inferior maxilla; began to lose his appetite, had slight headache and malaise, causing him to stop work after five days. May 1, he had difficulty in talking and swallowing, his voice was husky.

* *M. salivarius*—Biondi.—Morphology, cocci round slightly oval, stain by Gram's method; gelatin colonies, surface: round, grayish-white, which may become darker; gelatin stab, in depth beaded, white; potato: growth scanty; pathogenesis, inoculations of mice, guinea pigs and rabbits cause death in four to six days, cocci in organs, no inflammatory reaction in tissues; habitat, saliva of man.

After another day he had difficulty in breathing. May 3, he came to the hospital surgical dispensary when sublingual oedema was observed by Dr. Ivy. Then patient refused to remain in the hospital. The swelling continued to increase in size until 8 P.M. He had dull pain through his neck and cough and increased saliva. By the next day he had such difficulty in opening his mouth that he said he thought he was getting lockjaw and came to the hospital. He has been unable to sleep. He was finally received at the hospital May 4, 1908. He walked to the hospital. When admitted his temperature was 99.2°. Pulse, 92. Respiration, 26. Blood: leucocytosis, 12,200. The right cheek is swollen. There is a hard firm swelling the size of a half egg in the right submaxillary region. The submental region is also swollen from the symphysis to the hyoid bone and extends two fingers to the left of the median line. The sublingual tissue on the right side is markedly oedematous, being above the cutting edges of the teeth and pushes the tongue upward. On the left side it is only slightly oedematous. The tongue is covered with a gray pia. It is not swollen but it cannot be protruded beyond the lips. The face is flushed and the pupils dilated. Chest: lungs; left-apex resonance is impaired. The breath sounds are harsh. Remainder of lungs are clear. Heart: muscular tone is good. No murmurs. Abdomen is normal.

2.45 P.M. Operation by Dr. Price: One incision is made in the median line from without inward through the floor of the mouth. A second incision is made over the right submaxillary triangle through the mylohyoid muscle. A hæmostat is passed in beneath the mylohyoid from the lateral incision to the median incision and a rubber drainage-tube is inserted through and through. A third incision is made in the right sublingual tissue and a curette inserted. Nothing but blood and bloody serum removed. The blood clots instantly. No pus found. Wet dressing applied. Alcohol 65 per cent. Bichloride of mercury 1-4000 ää. Patient says that he feels much relief. Says that he can talk better.

7 P.M. Patient is expectorating large amounts of saliva and blood and blood-clots.

5-5-'08. Had only few short naps during the night.

(1st day.) Says he feels much better than before the incisions were made. Has less difficulty in swallowing and talking.

FIG. 1.



CASE IV.—J. D. Showing the swelling in the submaxillary and submental regions, also the incision and drainage tube into the submaxillary triangle.

FIG. 2.



CASE IV.—J. D. Showing the drainage tube passing from the incision in the submaxillary triangle to the median incision in the submental region.

FIG. 3.



CASE IV.—J. D. Showing swellings of the right cheek, submaxillary and submental regions

His voice is still husky. He still has pain on swallowing. No headache. No appetite. No shortness of breath. This A.M. his expectoration consists of a thick ropy mucopurulent material. Redressed. Discharge is bloody. Small amount of pus about the ends of the rubber tube. The sublingual and submaxillary swellings are about the same as yesterday.

(2nd day.) Examination shows increased sublingual swelling on the left side. Sublingual tissues extend above the level of the edges of the teeth. The submaxillary swelling on the left side has increased and is very hard. The left cheek is swollen. (Right side.) The submaxillary and sublingual swellings have markedly decreased and the submaxillary region is not so hard. Right cheek is still slightly swollen.

Second operation by Dr. Price: An incision one inch long, parallel to the inferior maxilla over the left submaxillary triangle, is made through the skin and mylohyoid muscle. A hæmostat is inserted and opened in all directions. To the left of the median line, one-half dram of pus is found. One or two large gas-bubbles are seen to come out with the pus. Cultures are made. The median incision is enlarged and a rubber drainage-tube is inserted through and through from the median line to the left lateral incision beneath the mylohyoid muscle. Original tube is removed and a fresh one is inserted in the region of the lateral incision. Wet dressings: Alcohol 65 per cent. Bichloride mercury, 1-4000 aa applied. (5 P.M.) Blood: Leucocytosis, 13,800. (6 P.M.) General condition is much better.

(3rd day.) Feels stronger. Sputum is foul and bad-tasting. He expectorates about two cupfuls each day, and each night. Examination shows all swellings much less than this A.M. Sublingual tissues especially appear almost normal. Swelling of right cheek has disappeared and swelling of left cheek is slight.

(4th day, 5-8-'08.) Blood leucocytosis, 8160. Slept almost the entire night. Expectoration for the night is one cupful. Appetite is better. Temperature, 98°.

Examination.—Swelling of left cheek has disappeared. Submaxillary and submental swellings are slight. Sublingual tissue appears about normal. Discharge is less and very foul. Steady improvement from this date and he was discharged from hospital well on tenth day.

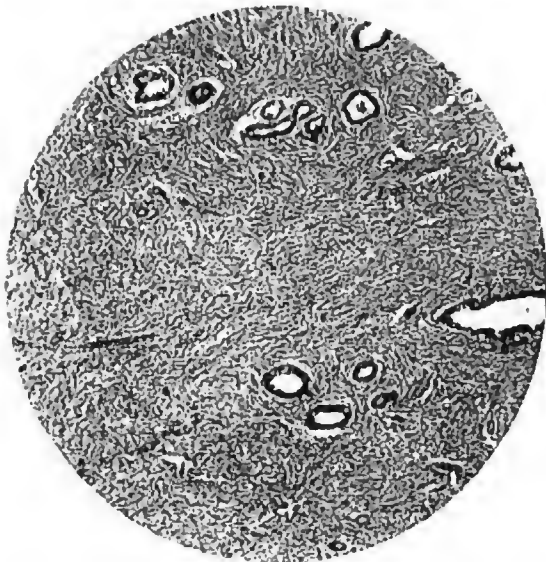
Cultures from incisions showed *micrococcus salivarius*—*Biondi*.

CASE V.—(Surgeon, Dr. Neilson.) C. B., female, age 16 years. May 1, 1908, patient had the first right molar extracted. May 8 she had cocaine injected around the second right molar and the tooth was extracted. On the following day she noticed a submaxillary swelling that was very hard and painful. Two days later she noticed sublingual œdema, also a hard swelling in the submental region. She complained of difficulty in swallowing and was able to sleep only three hours during the night. The sublingual œdema increased and the swelling below the jaw became larger and more painful and tender. Also difficulty in swallowing. Difficulty in talking. Her voice is husky. Difficulty in opening her mouth. Loss of appetite, headache and malaise. Breathing is not affected. Increased saliva that is thick and ropy. Applied for admission to hospital on the twelfth of May.

Physical Examination.—Well-nourished girl. Mouth: numerous carious teeth. The first and second molars are missing on the right side. The gums at this point is covered with a thin grayish-yellow slough. The sublingual tissues on the right side are œdematous but do not quite reach a level with the cutting edges of the teeth; on the left side they are slightly œdematous. There is a swelling of the right side of the face and neck extending from the malar bone to the sternum. The swelling over the submaxillary triangle and the submental region as far as the hyoid bone is very hard and of a shoe-leather resistance. There is no fluctuation. The anterior cervical lymphatics are palpable as a small chain of beads on the right side only. The thyroid gland seems slightly enlarged. W. B. C., 20,440.

Operation by Dr. Price immediately after admission. Local anæsthesia with ethyl chloride. Two incisions are made. One over each submaxillary triangle, parallel with the jaw and about one inch long. The incisions passed through the mylohyoid muscle. There was a free flow of blood and serum. Nothing that could be considered pus was seen. The subcutaneous tissues were quite œdematous. A hæmostat was inserted and opened in all directions and passed beneath the mylohyoid muscle from one incision to the other. A rubber drainage-tube was inserted through and through. Immediately relief followed the operation.

FIG 1.



CASE I.—Adeno-fibroma of the breast in a girl of 10 years.

FIG. 2.



CASE II.—Diffuse fibroma of the breast in a girl of 11 years. The general enlargement of the gland, tense and shining integument, and dilated subcutaneous veins simulated a sarcoma.

The following day the submaxillary and sublingual swellings were decreased. In the submental region the tissues were still quite hard. The swelling from the hyoid bone to the sternum had entirely disappeared. Patient much more comfortable. She expectorates a thick ropy white sputum profusely. Breath is foul.

Gradual subsidence of all symptoms, resulting in full recovery and discharged well on the eleventh day.

Cultures from incision showed *Bact. ferrugineum* (Dyal) and from aspirated material showed: large diplococcus, small diplococcus, long, thin bacillus, shorter, thicker bacillus, streptobacillus (strepto-diplo-bacillus?).

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