

A CASE OF AURICULAR FIBRILLATION WITH A POST MORTEM EXAMINATION *

ALFRED E. COHN, M.D., AND JAMES D. HEARD, M.D.

PITTSBURGH

CASE REPORT

History.—The patient, Mrs. T. G., was 37 years old. Her weight was 55 kilos. She was first admitted to St. Francis Hospital, Pittsburgh, Jan. 17, 1912; her chief complaint being shortness of breath. Dyspnea had been present during the past four to six weeks, during which period she had also experienced palpitation and precordial pain; occasional night sweats had occurred during the past few months, together with frequent "colds," during the course of which the patient would bring up blood-stained sputum. Her past medical history was as follows: She had chorea during childhood, rheumatic fever in 1908 and again in 1911, measles, diphtheria and small-pox in early life. She was not subject to sore throat. The patient had given birth to three healthy children and had had no miscarriages. She had worked hard. Her habits were good.

Examination.—The physical findings on the day following admission were, in brief, as follows: The patient was a slender, middle-aged woman, lying in bed without any apparent pain or discomfort. Her temperature was 98.4 F., pulse-rate 120 to 130, respiration 22 to 24, systolic blood-pressure 120. She coughed occasionally. There was slight cyanosis, but no jaundice nor edema. Her eyes, mouth and tonsils were negative. The external jugular veins were pulsating. The thyroid gland was not enlarged. The thorax was barrel-shaped and allowed only shallow respiratory excursions; there was a pronounced Harrison's furrow. Expiration was prolonged over the upper lobes of both lungs. Numerous moist râles were heard over the entire posterior aspect of the left lung and in the left lower axillary region. There was pronounced precordial bulging and diffuse heaving synchronous with the heart beat, the point of maximum intensity being in the sixth interspace slightly to the right of the left anterior axillary line. The cardiac impulse was marked and sudden and was preceded by a rough vibratory presystolic thrill. The right cardiac border was 5 cm. to the right of the mid-sternal line, and the left border 12 cm. to the left, at the third interspace. A presystolic rumble terminat-

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* From the Hospital of the Rockefeller Institute for Medical Research, New York.

ing in a sharp flapping first sound was heard at the apex and was followed by a short puffing murmur, heard over a wide area including the left axilla. The second sound at the pulmonic area was markedly accentuated and louder than that at the aortic area. The rhythm was regular. The abdomen showed marked epigastric pulsation. The blood, urine and feces showed no abnormalities.

Treatment.—The patient's condition remained unchanged for five days, during which period the pulse-rate averaged 120, the rhythm being always regular and the heart sounds continuing as noted at the first examination. It is not known whether digitalis had been administered before her admission, but on Jan. 22, 1912, the tincture of digitalis was first prescribed in the hospital, the dose being 1 dram a day. After the administration of one-half dram, the patient was awakened by severe palpitation. The resident physician noted at this time that the apex rate had fallen to 80 and that the pulse was grossly irregular in rhythm and in force. The patient was not seen by the physician in

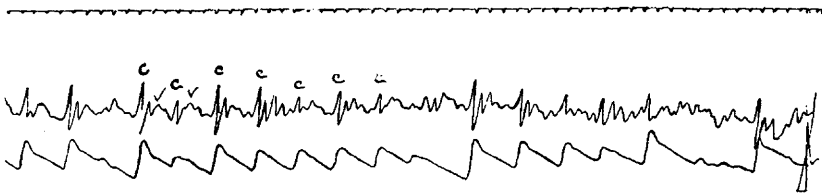


Fig. 1.—The upper line shows the time in 0.2 seconds. The second and third lines are curves of the jugular (venous) and radial pulses. Complete irregularity of the heart (auricular fibrillation) is present.

charge until 2 drams of the tincture of digitalis had been administered. The medication was then discontinued. It was noted at this time that the presystolic murmur and thrill had disappeared. In a polygraphic tracing taken January 24, the radial curve showed a *pulsus irregularis perpetuus*; and the venous, the ventricular type.

All subsequent tracings were of the same character, so that the conclusion was reached that auricular fibrillation was present. The slower rate of the ventricles continued until the patient was discharged from the hospital, Feb. 7, 1912. The change to a slower rate and an irregular rhythm coincided with rapid improvement in the general condition, and also in regard to dyspnea, cough and cyanosis. When the patient left the hospital, the circulation was restored to a condition of compensation.

Second Admission.—On her second admission, March 12, 1912, the patient was brought to the hospital in a condition of orthopnea. The temperature was 102.6 F.; the cardiac rhythm was completely irregular, the apex rate being 110; the respirations were 54 per minute. There was almost constant coughing with expectoration of much thin frothy

fluid which did not contain blood. There was marked general subcutaneous edema. Auscultation of the chest disclosed the presence of numerous fine and coarse râles which could be heard over the entire posterior aspect; resonance was impaired at both bases. The abdomen was dome-shaped and flat on percussion in both flanks. The liver was pulsating and its lower border extended 7 to 8 cm. below the costal margin at the mid-clavicular line. The urine contained albumin and hyaline and granular casts. Next morning at 9:30, after having passed a fairly comfortable night, the patient was in no distress. One hour

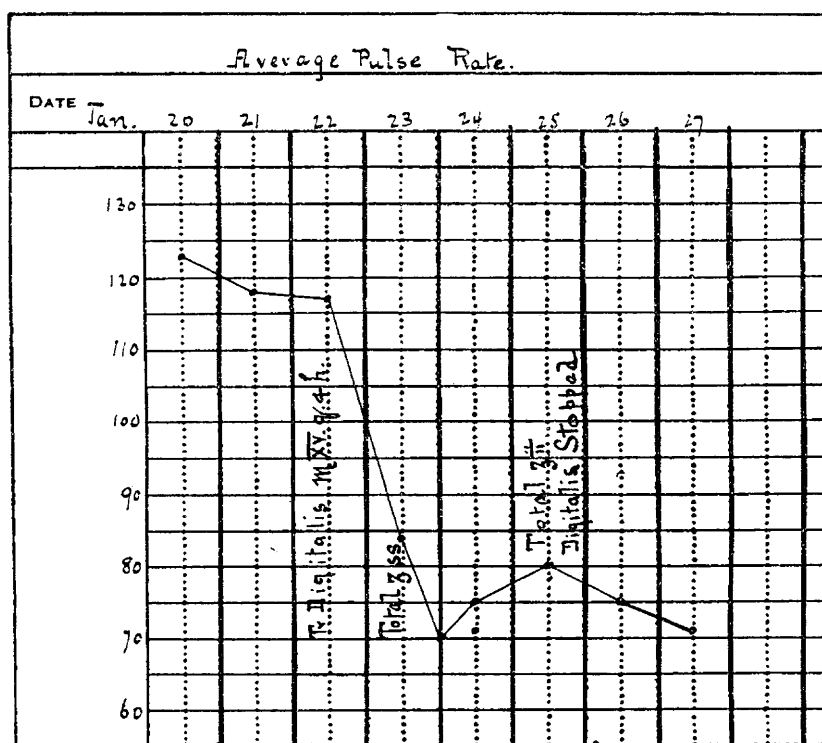


Fig. 2.—Chart showing average pulse-rate as affected by digitalis.

later she suddenly developed delirium cordis, with urgent dyspnea and general cyanosis. At this time Dr. H. G. Schleiter saw the patient with one of us in consultation, and it was decided to administer strophanthin intravenously, and to follow this by 1 dram of the tincture of digitalis daily by mouth. The injection was subsequently carried out by Dr. Schleiter, who has kindly furnished the following note and the accompanying tracing:

"March 13, 1912. At 11:20 a. m., the patient was in extreme distress, sitting up against pillows and panting for breath. The following con-

ditions were noted: The lower extremities were extensively edematous. The right border of the heart was 2 inches to the right of the mid-line; the left border was 4 inches to the left in the third interspace; the apex, 5 inches to the left in the sixth interspace. The pulse-rate, taken at the apex, was 164 per minute and showed complete arrhythmia. Jugular tracings were not obtainable, but the radial pulse showed beats varying constantly in time and force, with no underlying dominant rhythm demonstrable; it does not appear reasonable to doubt that auricular fibrillation was present. Fluid was present at the bases of both pleural cavities. Many crepitant râles were heard. There was ascites; the liver

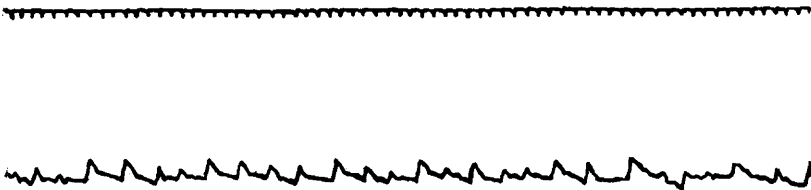


Fig. 3

Fig. 3.—A curve of the radial artery before the administration of strophanthin, 0.5 mgm., intravenously.



Fig. 4.

Fig. 4.—The same thirty minutes after the intravenous injection.

pulsated and the edge was felt at the level of the umbilicus. The patient was given an intravenous injection of 0.5 milligrams strophanthin. Within five minutes she appeared less ill, and in twenty minutes she was breathing quietly as if after a hypodermatic injection of morphin; the pulse, still showing fibrillation, had fallen to a rate of 116 per minute. A second injection of strophanthin (0.5 milligrams) was given at 3:30 p. m. It is of interest to note that after 7 drams of the tincture of digitalis had been administered, the pulse-rate had fallen to 84 per minute and the patient's condition had greatly improved. The heart

outline had not been reduced, the characteristic irregularity was still present, and the liver border still remained at the level of the umbilicus, where it had been on admission to the hospital."

On the day following and for several days subsequent to the injection of strophanthin, considerable pain and swelling were present in the arm which had been chosen for its administration. Urgent subjective symptoms did not return. During the first three days after the beginning of

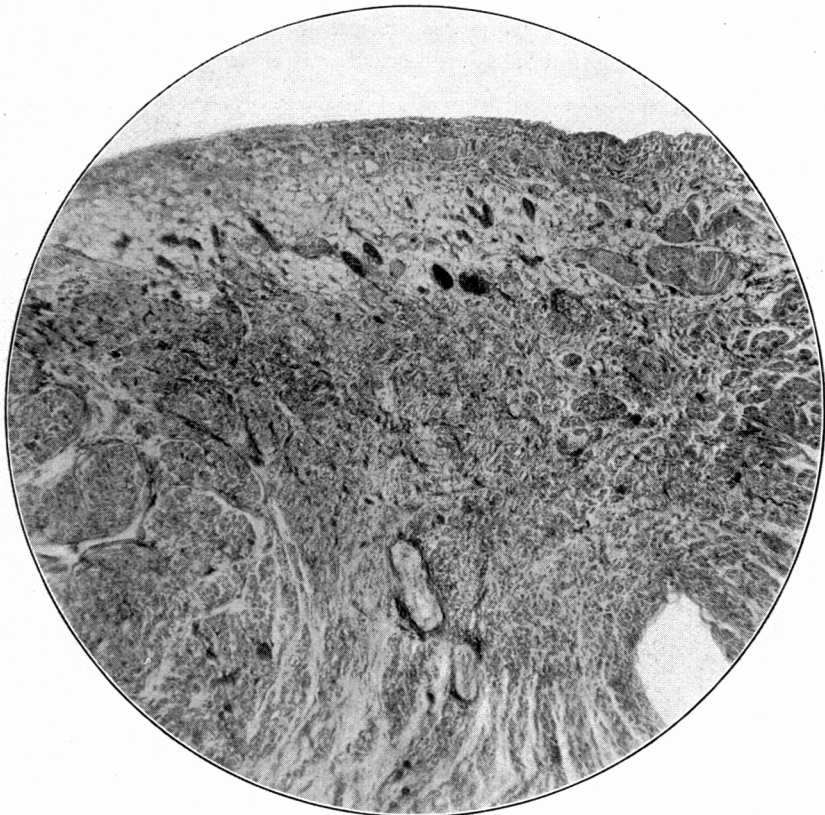


Fig. 5.—Microphotograph of the sino-auricular node. Slide 257. The pericardium is directed upward. The new-formed, thin-walled blood-vessels are seen in the subpericardial fat. The node has a triangular shape, base toward the pericardium.

the administration of digitalis, the rate of the heart occasionally reached 120 to 135, but subsequently it fell to normal and remained so after the withdrawal of the drug. Improvement was progressive. On March 24 the urine was free from albumin and casts. The patient was discharged in April, 1912, with the circulation fairly well maintained.

Third Admission.—About five weeks later, on May 21, 1912, the patient was admitted for a third time. She said that she had been very

comfortable since leaving the hospital, spending most of her time in her chair. She had taken no medicine. The evening before admission she began to be short of breath, the dyspnea soon becoming very urgent. On admission, the patient was found to be in a condition of marked decompensation. She had orthopnea, cyanosis, general edema, anasarca and albuminuria. The temperature was normal; the respirations 40; the rate of the heart at the apex 160; the radial pulse was weak and inter-

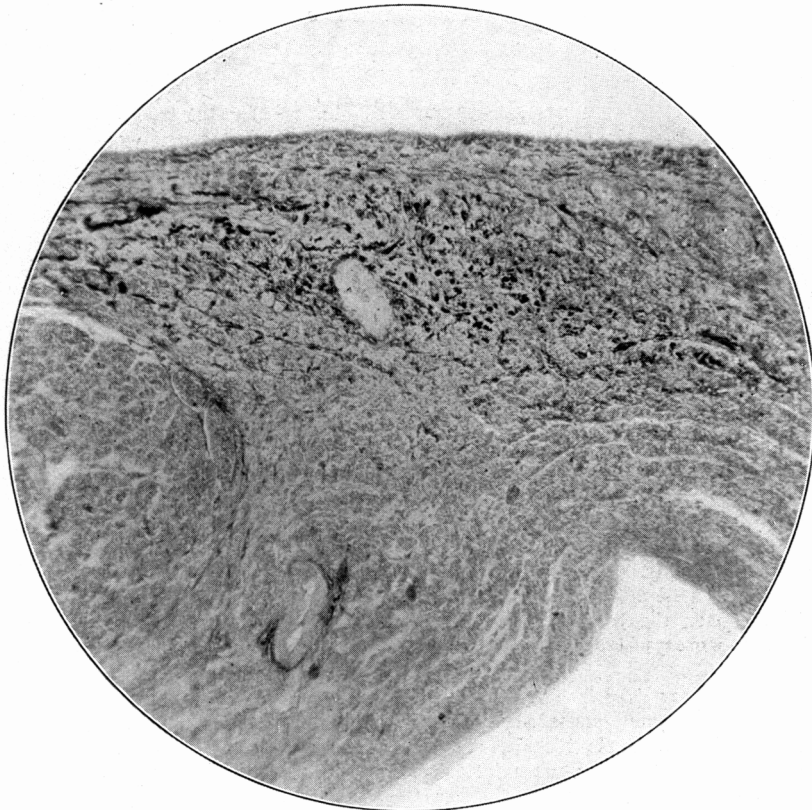


Fig. 6.—Microphotograph of the sino-auricular node. Slide 309. The node has an elongated form, its long axis parallel to the pericardium. A normal relation between muscle and connective tissue is seen.

mittent, the average rate being about 100; the area of cardiac dulness was like that on the previous admission; the lower border of the liver was at the level of the umbilicus. There was constant coughing and expectoration of much white frothy fluid. The patient was given the tincture of digitalis. She had four hours sleep after two injections of one-fourth grain of morphin sulphate. She suffered less discomfort next morning, but in the evening had marked dyspnea, tossed about in bed and refused, at

times, to answer questions. Strophanthin (1 milligram) was administered intravenously by the resident physician, but some of the solution escaped into the tissues so that it was not possible to determine the exact quantity which was absorbed. The patient gradually became more comfortable, but no striking change in her condition was noticed. May 23, 1912, the patient was very cyanosed and moved continually in bed. She was stuporous, but responded to questions. Her temperature was normal: the heart rate at the apex was 120, and the radial pulse 80. After a vein had been exposed by dissection, strophanthin (1 milligram) was injected into it, but without apparent result on the heart rate or mass movement of blood. Two days later, May 25, 1912, the temperature suddenly rose to 105.4 F., without a premonitory chill. The patient was very restless. There was marked icterus. The leukocytes numbered 15,000, and in the differential count there were 95.6 per cent. polynuclear cells. Twelve ounces of blood were withdrawn by venesection. During May 26, 1912, the temperature again reached 105.4 F. The patient was very restless and cyanotic. On the next day there was progressive failure of the circulation. The cardiac impulse was tapping in character, and the rhythm was grossly irregular. Pulmonary edema set in. The temperature ranged between 101 and 106 F. Death occurred May 28, at 2:30 a. m. Blood-culture showed the presence of an unidentified streptococcus.

An autopsy was performed several hours later by Dr. Oskar Klotz, to whom we are indebted for the report of the post mortem examination.

NECROPSY

The body was that of a slightly built woman of about middle age. The nutrition was fair. The pupils were both dilated, the left being larger than the right. The breasts were small and atrophied. There was some excoriation of the skin over the sacrum. The external orifices were without change. The skin tissue everywhere showed a marked yellow pigmentation, as did also the sclera.

Neck Organs: The trachea was a little congested but did not contain excessive exudate. The lymph-nodes at the bifurcation of the trachea showed a single small calcareous nodule the size of a mustard seed. The esophagus showed no change. The thyroid was not enlarged but was rather meaty looking. The tissue of the neck below the thyroid gland appeared edematous, and in it were several dark red lymph-nodes.

Thorax: There were some old adhesions along the posterior border of each lung. The apex on each side was free. There was no excess fluid in either pleural cavity. The pericardium contained about 75 c.c. of a clear yellow fluid.

Left Lung: The organ crepitated throughout. The tissues appeared a little heavy, but there was no evidence of edema. There was only a slight marbling of black pigment. On section the lung substance was a little congested. The arteries of the lung showed some irregular thickening of their walls. The hilus nodes were not enlarged. The bronchi appeared quite clear.

Right Lung: The organ was very similar to that on the left side. There was some slight congestion but no edema. In one of the main pulmonary arteries there was a flat area showing adherent grayish red clot. This clot did not obstruct the artery. The hilus nodes were without change.

Heart: See below.

Aorta: The aorta showed some diffuse thickening of the intima in the arch and in the descending thoracic portion. The carotid arteries showed some irregular nodular areas near the bifurcation.

Abdomen: On opening the abdomen the partially distended small intestine protruded. The great omentum showed an adhesion to the right of the broad ligament. The spleen was connected by old adhesions to the diaphragm. There were some old bands of fibrous tissue between the left lobe of the liver and the diaphragm. The left ovary had some adhesions to the sigmoid. There was no excess fluid in the peritoneal cavity.

Alimentary Canal: The stomach and intestines showed nothing unusual. There was some congestion of the lower portion of the small and large intestines. The mesenteric lymph-nodes were not enlarged.

Liver: The organ was rather swollen and was flabby. The outer surface of the left lobe showed some old adhesions. The organ was quite pale in color. The gall-bladder contained thick brown bile, which contained many pigmented granules. The liver on section was bright yellow, in which some dark red spots and streaks could be distinguished. The lobules were not distinctly marked. There was no evidence of fibrosis. The yellow areas were not definitely depressed but some resembled areas of necrosis.

Spleen: The spleen was tense and firm. On section the organ appeared dark and firm in certain areas, while in others the tissue was soft and could be readily scraped with a knife. The softer areas appeared more particularly in the center of the organ. The Malpighian bodies were indistinct.

Kidneys: Both organs were very much alike. In each instance the capsule was quite thin and not adherent. The cortex was gray and somewhat swollen; it was poorly defined from the medulla. The pelvis and ureters were normal.

Adrenals: Both adrenals were quite large. The cortex was red and showed no evidence of fat. The medulla was not enlarged and was of a gray color.

Bladder: The organ was of good size. The walls were thin and pale.

Genitalia: The tubes were both normal. The ovary in the left side contained a cyst 2.5 cm. in length. The uterus was normal in size and appearance. The cervix showed the presence of two old tears. In the vagina there was some excoriation of the epithelium on the posterior wall just below the cervix.

MICROSCOPICAL REPORT

Lymph-Nodes: The lymph sinuses throughout were much dilated, as were also the blood-vessels. The sinuses were filled with lymphocytes, a few polymorphonuclear leukocytes and occasional endothelial cells. There was much carbon pigment.

Lung: The alveoli were of usual size. Their walls were thin and there was no evidence of any inflammatory exudate into the alveoli.

Heart: Sections of the heart muscle showed a rather poorly staining tissue in which the muscle fibers did not stain evenly. The muscle fibers appeared rather narrow. The striations of the muscle fibers were indistinct and these were seen in broken fragments in the neighborhood of some of the blood-vessels. About these blood-vessels was an excess amount of connective tissue. In other places the capillaries lying between the muscle bundles were distended with blood with occasional extravasation of red blood-cells into the surrounding tissue. Here and there a number of polymorphonuclear leukocytes were seen in the interstitial tissue. Portions of the heart muscle cut on the freezing microtome showed an abundance of fat deposited within the muscle cells. This fatty degeneration was irregularly distributed through the tissue; in places it was very marked. Islands of connective tissue were also evident in the vicinity of the blood-vessels.

Thyroid: Sections of the thyroid gland showed tissue with many medium sized alveoli containing colloid material. The alveolar walls were quite thin and the epithelium somewhat flattened.

Kidney: In the cortex of the organ the glomeruli were of good size and they commonly showed fairly wide capsular spaces. The tubules of the cortex were large, many of them had wide lumina and contained some debris. The cells lining the tubules were of irregular size and stained poorly.

Liver: The structure of the organ was much altered. The central zones of the lobules were almost entirely destroyed, there being no liver columns in these regions. The sinuses were much dilated and there appeared to be an extravasation of red blood cells into the surrounding tissues. Each lobule showed only a rim of liver cells in the periphery.

Spleen: The organ was intensely congested so that the normal markings were almost obliterated. The Malpighian bodies were small.

BACTERIOLOGICAL REPORT

Blood taken a day before death contained streptococci. The biologic character of this organism was not identified.

Pathologic and Bacteriologic Diagnosis: (Rheumatism); chronic sclerotic mitral endocarditis; stenosis of mitral valve; chronic interstitial myocarditis; chronic sclerotic aortic endocarditis (slight); dilatation of heart (left ventricle and right auricle); hypertrophy of heart (left ventricle); milk spots of heart; fatty degeneration of heart; acute interstitial myocarditis; hydropericardium; thrombosis of pulmonary artery; sclerosis of pulmonary artery; old bilateral pleural adhesions; obsolete tuberculosis of peribronchial glands; chronic congestion of lung; peritoneal adhesions; chronic perisplenitis; cardiac spleen with acute splenitis; chronic perihepatitis; nutmeg liver; bile sand; central necrosis of liver; hemorrhage into liver; cloudy swelling of kidney; enlarged adrenals; cyst of ovary; chronic perisalpingitis; old laceration of cervix; decubitus ulcer of sacrum and vagina; septicemia (streptococcus).

TECHNIC OF EXAMINATION OF HEART

Heart: The heart was fixed in Zenker's solution. The area containing the sino-auricular node was washed and hardened in alcohol. The rest of the heart was taken out of Zenker's solution, washed in running water and then sent for examination in a 1 per cent. formaldehyd solution. It was then washed and preserved in alcohol. The length of the heart in the fixed state was 12 cm. from the auriculo-ventricular groove to the apex on the anterior surface, and 9 cm. on the posterior surface. There was a moderate amount of subpericardial fat along the right border of the heart; here there was a milk spot measuring 4 by 2.5 cm. A similar one measuring 1.5 by 1.5 cm. was found near the apex on the anterior surface of the right ventricle. The cavity of the right auricle was dilated but not hypertrophied. The endocardium was white and somewhat yellowish. A small Chiari net guarded the opening of the coronary sinus. The tricuspid valve admitted three fingers; the borders of the flaps were thickened. The right ventricle was neither dilated nor hypertrophied. The pulmonary valve was normal. The cavity of the left auricle was much dilated. The endocardium was thick and white. There were no vegetations. The mitral valve admitted two fingers. The edges of the flaps were much thickened and were rolled in on the auricular surface. The cavity of the left ventricle was slightly dilated but not hypertrophied. The wall measured 15 mm. at the base, 17 mm. at the level of the papillary muscles and 8 mm. at the apex. The outflow tract of the ventricle was more dilated than the left half of the cavity, and the endocardium lining it was white. The chordae tendineae were shorter and slightly thicker than normal. There were two small false posterior moderator bands. The corpora Arantii of the cusps of the aortic valve were thickened. The cusps themselves were adherent to each other at their points of intersection; otherwise they were normal. The coronary arteries were normal. The heart presented no congenital anomalies.

Sino-Auricular Node: The area at the cavo-auricular junction containing the sino-auricular node was hardened, embedded, cut and stained in the manner

employed and described elsewhere.² The sections were cut at a thickness of 12 microns at right angles to the long axis, and every fifth section was mounted. On account of the fixation in Zenker's solution, bichlorid precipitation occurred but was removed successfully by immersing the sections in Lugol's solution for one week before staining. The number of sections cut was 2,235, so that the length of the node after embedding was 26.82 mm.³ The relation of the upper extremity of the node to the cavo-auricular junction could not be ascertained because the tissues had been excised from the heart before it was sent for examination, and the normal morphologic landmarks were consequently destroyed. The shape and dimensions of the transverse section of the node varied at different levels. In its upper extremity it was circular and its diameter was 1 mm. It lay directly under the pericardium, the wall of the auricle measuring 3.5 mm. There was a small hemorrhage close to the node. In the subpericardial fatty and connective tissue and also sometimes encroaching on the substance of the node itself, but confined almost wholly to the nodal area, there were many thin-walled blood-vessels, probably inflammatory or degenerative in origin. All of these, as well as the other vessels seen in this series, showed very marked congestion. A short distance below its upper extremity, the node lay 2 mm. deep from the pericardium and precisely at the junction of the taenia terminalis and the atrium. It measured 4 by 0.5 mm., the long axis being parallel to the pericardium. The shape was roughly triangular, except that the angles were much rounded off. The structure of the node, aside from the abnormalities noted, was normal, both in the total quantity of muscle present and in the relation of this amount to that of connective tissue. An unusual arm projected outward from its left border toward the pericardium, continued parallel with it a short distance and was finally lost in the muscular structure of the auricle. At a level still lower, the node measured 6 by 1 mm. and lay only 0.5 mm. from the pericardium. The largest proportions the node attained were 6.5 by 1.5 mm., 13.74 mm. from the upper extremity. From this point onward, the dimensions of the node became rapidly reduced and the structure terminated in a tail, the larger part of which was formed of connective tissue.

The relation of muscle to nerves and ganglia was unusually close. At all levels there were collections of ganglion cells in the space between the pericardium and the muscle layer. Nerve bundles, both small and relatively large, were found in the same situations and also within the structure of the node itself. About the nerve ganglia and nerve fibers the new-formed, thin-walled blood-vessels, which have been described, were found in rather large numbers. The artery, which is so often found in relation to the node, had at a low level a distinct reduction in the diameter of the lumen, due to an endarteritic process. This vessel showed no other point of interest except collections of smooth muscle fibers arranged in bundles and irregularly distributed about the vessel as an external longitudinal layer, similar to that which has been observed to lie about the central venous sinuses of the adrenal glands.

The Conduction System: The block containing this system was excised in the usual manner. It was cut in sections 12 microns thick in a plane at right angles to the long axis of the heart. Every fifth section was mounted. In the inter-auricular septum both muscle tissue and fat showed the presence of many leukocytes and lymphocytes in groups and also lying between the strands of muscle fibers. The auriculo-nodal junction was of sufficient size but was inflamed. The auriculoventricular node was of normal size, large rather than small, showing the characteristic interlacing of the fibers, but poorer in nuclei than is usual. There was a fairly well marked inflammatory process of the nature described and also moderately large collections of inflammatory cells within the substance

2. Heart, 1911, ii, 245.

3. The length of the node in another heart weighing 899 gm., already reported (Heart, 1912, iv, 24) measured 21.55 mm. Koch (*Med. Klin.*, 1911, No. 12) gives the length as about 3 cm., but cites no specific examples.

of the node. A similar inflammatory lesion was also found near the beginning of the main stem. It lay just outside the bundle and extended a short distance along the sheath. It did not compress the bundle. The main stem was large, well-developed, normal in appearance and intact from auricles to ventricles. Just before the division of the main stem into the ventricular branches, there was another area showing an infiltration with leukocytes and lymphocytes. From the point of division onward, the branches, more especially the right, showed only slight inflammatory lesions. Both branches were normal in size, the right a little larger than the left at the beginning.

Résumé: The sino-auricular node showed normal relations between the amounts of connective tissue and muscle; there was no sclerosis, but an inflammatory lesion in slight part within the substance, but for the most part without, though in the neighborhood of the node. The auriculoventricular node was inflamed to a far greater extent than the sinus node and contained abscess-like bodies. Similar smaller collections were found in the main stem. Congestion was a marked feature of the lesion throughout. There was no break in continuity of the conduction system.

DISCUSSION AND SUMMARY

A case is described in which, while the patient was under observation, a sequential rhythm changed to complete irregularity of the cardiac mechanism, due to auricular fibrillation. It is extremely doubtful whether the one-half drachm of digitalis which the patient received could have been responsible for the altered rhythm, even if she had been given the drug before admission to the hospital, five days before. Neither can the fall in ventricular rate from 120 to 80, occurring with the onset of fibrillation, be ascribed to an administration of digitalis extending over only half a day. The fall in rate occurring with the onset of auricular fibrillation is difficult to explain, but it occurs in other conditions of which we have only slight knowledge. The action of strophanthin administered intravenously was studied and showed a strikingly beneficial effect on the circulation and the subjective symptoms of the patient. The post mortem examination showed a lesion of the sino-auricular node, but it cannot be definitely asserted that a relation exists between the lesion described and the clinical irregularity that was studied.