

HEKTOEN (4,)

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THE HEART:

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MYOCARDIUM;

IMPLANTATION SARCOMA OF THE RIGHT VENTRICLE;

PRIMARY ROUND-CELLED SARCOMA OF THE  
EPICARDIUM.

BY

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OF CHICAGO.

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**THREE SPECIMENS OF TUMORS OF THE HEART:  
METASTATIC CARCINOMATOUS NODULE  
IN THE MYOCARDIUM, IMPLANTATION-  
SARCOMA OF THE RIGHT VEN-  
TRICLE, PRIMARY ROUND-  
CELLED SARCOMA OF THE  
EPICARDIUM.<sup>1</sup>**

BY LUDVIG HEKTOEN, M.D.,  
OF CHICAGO.

IN his recent review of the literature concerning tumors of the heart, Alessandro Tedeschi<sup>2</sup> estimated that about 80 cases have been described, to which number he added three of his own. Martinotti collected 60 cases in 1886, and in 1891 Pil and Bret found 77. The *Index-Catalogue* of the Library of the Surgeon-General's Office at Washington—the volume finished in June, 1884—contains references to 85 cases, and this number does not include echinococcus-cysts, gummata, or tuberculous masses, and the *Index Medicus* from 1885 to 1892 inclusive has references to 21 additional cases, so that it would seem that the grand total at the present time must be about 110 instances. Under any circumstances this will indicate sufficiently well that

<sup>1</sup> The specimens were presented to the Chicago Pathological Society, Oct. 10, 1893.

<sup>2</sup> Prag. med. Wochenschr., 1893, Nos. 11 and 12.



tumors of the heart are among the rarest of conditions.

The majority of cardiac neoplasms are secondary, consequently, as a rule, either carcinomatous or sarcomatous, the first being the more frequent. It is very seldom that the heart becomes involved by direct extension through continuity and contiguity of tissue on the part either of a sarcoma or a carcinoma of an adjacent organ. The primary cardiac neoplasms are necessarily mesoblastic in origin, and instances of almost all the forms of mesoblastic tumors are described in connection with the heart. Berthensen<sup>1</sup> found 28 primary heart-tumors to include 9 sarcomas, 7 myxomas, 6 fibromas, 3 carcinomas (Krebsgeschwülste, etc.), 2 fatty tumors, and 1 cyst.

I shall describe an instance of each of the following forms of cardiac tumor, namely: A metastatic carcinomatous nodule in the wall of the right ventricle secondary to a medullary carcinoma of the breast; an implantation-sarcoma of the right ventricle, secondary to an osteo-sarcoma of the tibia; and, finally, a primary round-celled sarcoma, originating in the epicardium upon the anterior surface.

All of these cases occurred in the Cook County Hospital, of Chicago, during 1892 and the beginning of 1893.

CASE I. *Medullary carcinoma of the breast; general dissemination; nodule in the wall of the right ventricle.*—A woman, fifty years of age, died from an ulcerated medullary carcinoma of the right breast. The post-mortem showed metastases in the lungs,

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<sup>1</sup> Virchow's Archiv, Bd. cxxxii, H. 3.

the peritoneum, the liver, the Fallopian tubes, the uterus, and the pericardium. In the wall of the right ventricle at the right border was a mass  $4 \times 3 \times 2.5$  cm. in size, situated beneath the pericardium, and projecting up into the wall of the auricle; it was surrounded by large vessels, was very firm, grayish-white, and infiltrating; and in the immediate vicinity were smaller masses. The endocardium was not changed.

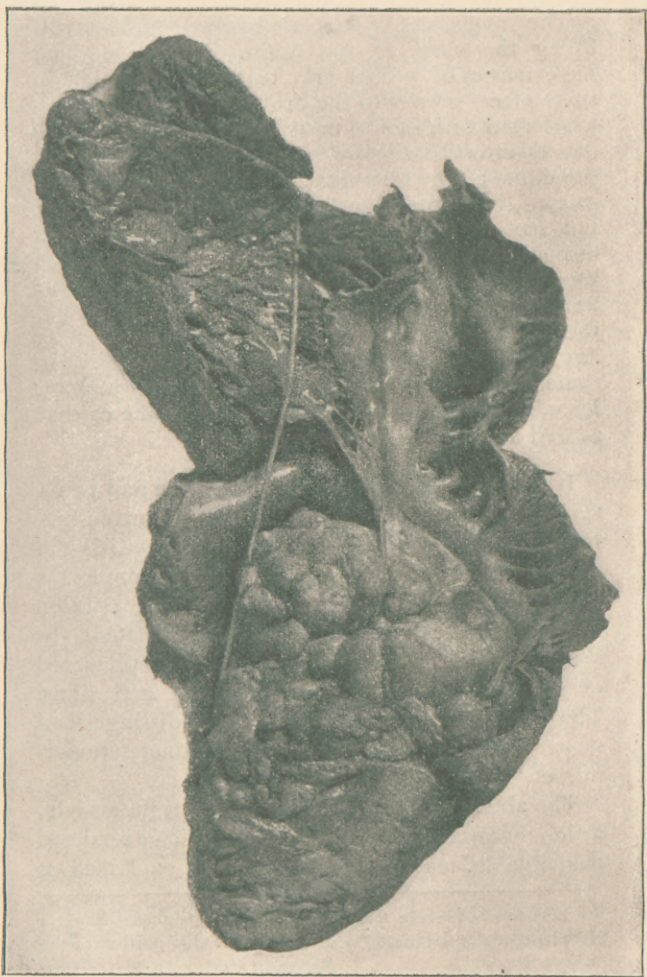
Manifestly, this metastasis occurred through the coronary arteries during the process of general dissemination.

CASE II. *Spindle-celled osteo-sarcoma of the tibia; implantation-sarcoma of the right ventricle; extensive pulmonary dissemination.*—The following is an extract from the clinical record: A boy, twelve years old, was sent to the hospital with the diagnosis of osteo-sarcoma of the upper end of the left tibia. Disarticulation through the knee-joint was performed in January, 1892. In February recurrence took place at the lower end of the femur, and on May 14th disarticulation at the hip was performed. The patient was discharged four weeks later in good condition, but was readmitted July 30, 1892, into the service of Dr. C. A. Earle, on account of shortness of breath, nocturnal cough, and loss of flesh and of appetite. The examination then showed: Anemia; no local recurrence; the left chest moved less than the right; there was dulness on percussion over the upper third of the right lung, and over the middle third of the left posteriorly; bronchial breathing and resistant bulging of the intercostal spaces were present. The bones and joints, as well as the abdominal organs, were apparently normal. On August 4th the area of dulness over the left lung had extended downward. There was no palpable apex-



beat, but epigastric pulsation could be made out; the sounds were rough, the first sound being almost changed into a murmur. On August 8th flatness was noted over the entire left lung, the heart's dullness not being distinguishable. The intercostal spaces were bulging over the flat areas. The sputum contained large, nucleated cells, but no tubercle-bacilli (ten slides, Dr. Eastman). Weakness and dyspnea increased, and death occurred August 14th, about eight months after the appearance of the first swelling upon the left tibia. The clinical diagnosis was secondary pulmonary sarcoma.

The post-mortem examination showed no recurrence in the tissues about the hip; the sciatic nerve presented microscopically an amputation-neuroma. There were no growths in any of the vessels below the heart or in any of the abdominal organs. Externally the heart presented an unusual prominence along the right ventricular border, which could be felt to be due to a nodular growth in the right ventricle. The heart weighed 250 grams. It was found that from the wall of the right ventricle along the right border sprang a lobulated mass of white, hard tissue which formed an intra-ventricular, nodular growth filling very nearly the whole cavity, projecting up underneath the tricuspid valves, and leaving only the upper part of the ventricle free to transmit the blood into the pulmonary artery. This mass was grayish-white, firm, containing in some places hard bony masses; it extended in between the muscular trabeculæ and down into the myocardium of the ventricle; the free surface was smooth, nodular, free from thrombotic deposits and from evidences of surface-disintegration. Otherwise the heart was normal. In spite of the manifest stenosis of the tricuspid orifice there was no hypertrophy or dilatation of the right auricle.



Osteo-sarcoma of the right ventricle, due to implantation, and secondary to osteo-sarcoma of left tibia. (Case II.)

The lungs were of increased volume and weight, filling the chest to distention. They contained huge masses of whitish-gray tumor-tissue, which in some places grew into the bronchi, which thus communicated with foci of mucoid degeneration; these masses crowded the pulmonary parenchyma in all directions; they were sharply defined, almost encapsulated, in places undergoing mucoid degeneration, but mostly dense and hard, containing distinct osteoid districts that nicked the knife and scratched the palpating finger. The microscopic diagnosis was: Small spindle-celled osteo-sarcoma of the heart and the lungs. The structure was so typical as to render any detailed description quite unnecessary. In some places mucoid degeneration was present. Islands of osseous tissue were present in the cardiac as well as in the pulmonary growths.

It is to be regretted that a very minute and painstaking examination of the heart was not made during life, with a positive diagnosis of its condition in view, because it does seem probable that under the circumstances an approximately correct opinion could have been reached, although it must be acknowledged that the pulmonary lesions presented overwhelmingly prominent symptoms and signs. Thus the heart's dulness could not be distinguished on account of the adjacent pulmonary tumor-masses.<sup>1</sup>

The absence of hypertrophy of the right auricle, which the anatomic condition seems to have rendered unavoidable, may be quite rationally explained as

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<sup>1</sup> Berthenson's article, "Zur Frage von der Diagnose primärer Neoplasmen des Herzens," loc. cit., covers this portion of the subject thoroughly.



due to the increasing cachexia, which is in accordance with the views generally held as to the absence of cardiac hypertrophy under analogous local and general states. Then again the marked diminution in the size of the cavity of the right ventricle may in part explain the absence of the hypertrophy, as the blood was probably forced directly through the upper part of the ventricle into the pulmonary artery.

Another very interesting feature in this case is the mode of formation of the metastasis in the right ventricle. The metastatic process was confined entirely within the limits of the lesser or pulmonary circulation, into which sarcomatous emboli were introduced from the primary or the recurrent tumors in the left lower extremity through the blood-current in the ascending vena cava. In reality, the metastasis in the right ventricle depended either upon implantation upon the endocardium of sarcoma-cells coming directly from the primary or recurrent tumors, or it was due to infection carried back again from the secondary pulmonary growths. Sarcomatous emboli from the lungs might under favorable circumstances reach the right ventricle along either of the two following routes :

1. Through the pulmonary veins, the left auricle and ventricle into the coronary arteries, lodging in the capillaries of the myocardium; this route brings the systemic circulation into play, and in the absence of generalization of the secondary tumors, which would seem well-nigh unavoidable under these circumstances, any further discussion upon this particular point is unnecessary.

2. Through the bronchial veins, the vena azygos major and the superior intercostal vein, the superior vena cava, into the right auricle and ventricle, endocardial implantation of the sarcoma-cells leading to the formation of the large metastatic growth. Consequently there is practically no other explanation to be offered of the mode of growth of the tumor in the right ventricle in this case than by implantation directly upon the endocardium of sarcomatous cells or a mass coming through the inferior cava from the primary or recurrent tumors, or through the superior cava from the secondary pulmonary growths. In all likelihood the implanted cells came directly from the tumors in the extremity, along with the other emboli which were carried directly into the pulmonary capillaries. Of course it is not at all impossible that the implantation-sarcoma in the right ventricle distributed cells and masses into the lungs from time to time.

The instructive observations of a number of pathologists showing free tumor-cells and particles in the blood have, of course, a very direct bearing upon the question of growth from endocardial implantation. Bozzolo found tumor-particles in cruor masses in the right ventricle; v. Recklinghausen found sarcoma-bits in the right ventricle growing upon the endocardium between the papillary muscles; and Rieder, Weber, Lücke, Paulicki, Birch-Hirschfeld, and Laveran are cited by Tedeschi<sup>1</sup> as having made similar observations. Tedeschi himself studied an instance of recurrent round-celled sarcoma of the thigh, during the growth of which

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<sup>1</sup> Loc. cit.

there developed some 300 metastases, and he found in the clots in the heart-cavities numerous white particles consisting of tumor-cells; in this case the heart contained innumerable metastatic nodules, and he very properly regards the cell-masses in the blood as indicating the mode of dissemination.

In this case, then, the course of events may be outlined in this way:

1. Primary, small spindle-celled osteo-sarcoma of the tibia; recurrence in the stump after amputation through the knee joint in January, 1892.

2. Dissemination into the pulmonary circulation before disarticulation at the hip, *i. e.*, some time before May 14, 1892.

3. Death from pulmonary and right intra-ventricular metastatic sarcoma, August 14, 1892.

4. The growth in the right ventricle came from direct implantation of sarcoma-cells upon the endocardium, and subsequent development in the direction of least resistance, *i. e.*, out into the cavity and between the muscular taberculæ.

CASE III. *Primary round-celled sarcoma of the epicardium.*—An American Indian woman came into the Cook County Hospital moribund and died without a clinical record of any kind being obtained, except that she was fifty years old. She was quite well nourished. The post-mortem examination showed a fatty liver, pulmonary emphysema, and chronic nephritis. The following is a description of the heart: There is firm and complete pericardial obliteration; after carefully removing most of the parietal pericardium and cutting off the vessels near the base of the heart, a mass including a tumor which weighs altogether 448 grams remains. Sit-



uated upon the anterior surface of the heart is a tumor, shaped something like a cone, the base being the upper, and the apex the lower limit; the long diameter from base to apex is 8 cm., and the diameter of the base itself is 7 cm.; the inter-ventricular septum passes under the center of the mass, which considerably overlaps the commencement of the pulmonary artery. This tumor appears to spring from the epicardium, and between the posterior surface and the myocardium proper is a layer of yellow fat, while the connection with the pulmonary artery is quite intimate. Externally the mass is covered by a thin layer of fibrous tissue—the epicardium—except posteriorly, where the capsule is continuous with the rest of the epicardium. The growth is quite firm and a little lobulated. Its cut surface is grayish-yellow, smooth, glistening, and homogeneous; large blood-spaces appear in the section. Internally the heart is quite normal, there are no endocardial changes, and the ventricular cavities and walls are not larger or thicker than normal.

There were no growths in any of the other organs examined, but unfortunately the investigation as to this point was not quite thorough enough, as it did not include the intestines and the brain, bones or joints.

*Microscopic appearances.* At the periphery of the mass is a quite thick layer of fibrillated connective tissue, in which are many large and irregular spaces, partly or wholly filled with blood. From this capsular layer of fibrous tissues, interlacing bands of varying width pass into the tumor proper, forming spaces of different sizes. The tumor is otherwise made up of round cells, reproducing quite typically the small round-celled sarcoma. The cells are, comparatively speaking, small, with large

nuclei that stain deeply. In many places the tumor consists of diffuse areas of infiltrating round cells, separated by a faint and delicate intercellular network; in such districts, small, thin-walled blood-vessels containing blood occur occasionally. In other places again the spaces alluded to are filled closely or loosely with the round cells, and here the appearances are not at all unlike those seen in sections of certain carcinomas, but there is usually an intercellular network to be made out connected with the grosser bands of fibrous tissue. There is no pigment present. In conclusion it may be said that this tumor in part presents the structure of a small round-celled sarcoma, in part that of the so-called lympho-sarcoma.

This then is without much, if any, doubt a primary sarcoma of the epicardium of the anterior surface of the ventricles, and it is interesting not so much on account of its structure as on account of its very unusual point of origin, namely, the sub-epicardial areolar tissue.

In this case it is also exceedingly regrettable that a thorough physical examination could not be made, because it would have been very instructive to have a record of the physical signs presented on the part of the heart. Here again there is noted absence of hypertrophy and dilatation of the heart, although the weight of the tumor itself, as well as the pericardial adhesions, would seem to be ample causes of increased labor for the heart. The post-mortem examination did not disclose any satisfactory explanation of the absence of hypertrophy.

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