SPECIFIC LESIONS OF PERIPHERAL BLOOD VESSELS IN RHEUMATISM *

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In the present uncertainty as to the causative agent of rheumatic fever, it is not possible to establish with finality the rheumatic nature of any given lesion. However, the frequent or constant association of a lesion with the clinical or pathologic features of rheumatic fever and its resemblance to other lesions generally recognized as associated with rheumatic infection, are presumptive evidence in favor of its rheumatic origin. Additional support is gained if the lesion in question has histologic features which are distinctive and which are not encountered in other known diseases. The specificity of the Aschoff nodule, indeed, of all rheumatic cardiac lesions, rests upon no firmer foundation than this.

That the virus of rheumatic fever may produce specific lesions of the aorta has been clearly shown.[1] It would not, therefore, be surprising to find that the smaller peripheral vessels should at times be the seat of rheumatic lesions. This in truth has proved to be the case.

A peculiar type of vascular inflammation has been found in a series of cases of rheumatic carditis, and in our experience in no other disease, so that we believe it to be specific and characteristic. We wish in this paper to describe the distinctive features of these lesions and to present detailed evidence in favor of their rheumatic origin. The material studied consists of a series of forty-seven consecutive cases of rheumatic heart disease, and of these the lesions were found in ten.

DISTRIBUTION OF THE LESIONS

The vascular changes to be described have thus far been found in the following situations: lungs, aortic valve, kidney, perirenal and periadrenal adipose tissue, appendix epiploica of the sigmoid colon, ovary, testis, pancreas and in a small polyp of the cecum. In most

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of these regions, only isolated vessels have been affected. As regards the lungs, however, two cases have been studied in which practically every small branch of the pulmonary arteries has been involved; in the kidney also the lesions have been quite widespread. The subcutaneous fat, joints and skeletal muscles have not been included in our routine material, so that we cannot speak of the possible occurrence of similar lesions in these tissues.

Histopathology of the Lesions

The alterations involve the entire thickness of the vessel wall and frequently, though not invariably, throughout its entire circumference.

The endothelium is swollen and basophilic, but appears intact. It may be exfoliated into the lumen (Fig. 1); this may in some instances take place after death while in other cases it is obviously lifted off by the accumulation of a coagulable exudate beneath it (Fig. 2). In no case has this alteration of the endothelium led to thrombus formation.

The wall of the vessel appears thick in comparison to the caliber of the lumen and this increase in thickness is particularly striking when only a portion of the circumference is affected. The thickening in the early phases of the lesions is due primarily to the infiltration of the vessel wall with fibrin (Fig. 3). This appears in the form of coarse interlacing strands staining pink with eosin, yellow with Van Gieson and blue with the Weigert fibrin stain. The fibrin threads in small vessels may extend into the contiguous cellular tissue, so that the original boundaries of the vessels are obscured (Fig. 4). In larger arteries the fibrinous exudate is often limited by the internal elastic lamella; in these cases, the threads are circumferentially disposed (Fig. 1).

Accompanying this deposition of fibrin, there occurs a necrosis of the cellular constituents of the vessel wall, as shown by the chromatin fragments scattered amongst the fibrin threads. In some vessels there is also extravasation of red blood cells, either immediately beneath the endothelium or in the meshes of the fibrin.

External to the necrotic wall of the vessel is a cellular tissue having a very distinctive and peculiar appearance (Fig. 5). It is composed of a loose fibrillar stroma, in part fibrinous, in which are many nuclei.

One may distinguish (1) lobed nuclei of polymorphonuclear neutrophiles, many of them pyknotic and fragmented, especially those nearest the vessel wall; (2) larger vesicular nuclei, staining less intensely than those of the polymorphonuclears and often distorted or compressed into bizarre elongate or club-shaped forms. They tend to be arranged radially. Still further out is a loose infiltration of lymphoid and plasma cells, occasional eosinophiles and young connective tissue cells. In this tissue are many dilated hyperemic capillaries, the largest often exceeding the diameter of the affected vessel. The zone of capillary distention frequently extends far beyond the area of cellular infiltration and is a constant and conspicuous feature of the early lesions (Fig. 10).

The behavior of the elastic fibers in the affected vessels can best be followed in serial sections. The earliest change noted in the internal elastic lamella is a swelling and partial alteration in the staining reaction, so that the fibers appear beaded and discontinuous (Fig. 1). As one follows the vessels into the region where there has occurred exudation of fibrin, the internal elastic lamella may become more difficult to distinguish (Fig. 11) and finally disappears altogether. Before this point is reached, one may observe that it has become greatly stretched and attenuated by the fibrin which has been deposited beneath the endothelium, and actual rupture often takes place, the ends becoming widely separated and everted. The gap between the ruptured ends is filled with a mass of fibrin.

The external elastic coat is even more difficult to trace, since in the small vessels affected it is often incompletely developed or even wanting. A few delicate fibrils persist and are pushed outward by the accumulated exudate (Fig. 11).

The recognition of a well formed wavy elastica interna, when the vessel is followed in series to a point where the injury is less severe, is evidence that the lesion may affect the small arterial branches.

In other instances, it is impossible even in serial sections to find any traces of an elastic coat, the thinness of the wall, as compared with the diameter of the lumen, indicating that the affected vessel is either a capillary or a precapillary venule.

Additional evidence that the lesion may affect capillaries was obtained in studying sections of an ovary. Here the vessel involved lay in the wall of a small cyst with the edema and cellular infiltration about it elevating the cyst wall into a rounded prominence which

projected into the cavity. When this vessel was followed in serial section, it could be traced directly into a sinusoidal capillary composed only of an endothelial lining with its basement membrane (Fig. 5). A similar observation was made in an affected capillary in the substance of the aortic valve.

It has been impossible to demonstrate bacteria in these lesions, either in the Gram-Weigert or methylene blue stained preparations.

In the larger arterioles of the lung the picture is slightly modified. The reactionary zone about the vessel is often inconspicuous or wanting, even when the infiltration of the media with polymorphonuclears is intense (Fig. 7).

Reparative Changes

The fibrinous exudate is gradually replaced by a permanent tissue. The fibrin filaments become swollen and fused into compact homogeneous masses which for a time retain the specific staining reaction. Isolated clumps of fibrin may be found even after the reparative process is well established.

Branching and polygonal cells with deeply staining vesicular nuclei, usually single but occasionally multiple (Fig. 11), appear amongst the fibrin threads. These we believe to be derived from the endothelium. Where there have been clefts or spaces left by the retraction of the fibrin, these cells tend to line them; and where extravasated red cells lie free in the meshes of the fibrin, the cells seem to encompass them and to establish new blood channels. There has never been observed any ingrowth of fibroblasts or newly formed capillaries from the adventitial tissue. This secondary vascularization of the intima is an amazing feature of the lesion. When fully developed, the original central lumen of the vessel which persists throughout, becomes surrounded by a spongy or vascular tissue composed of tensely congested, newly formed sinuses separated by a loose fibrous tissue. When followed in series, these newly formed channels are found to communicate in many situations with the original lumen on the one hand, and with collateral vessels on the other (Figs. 8 and 9).

The internal elastic lamella which has originally been displaced outwards by the exuded fibrin, may persist and may even become fortified by the development of a few fibrils which penetrate into the loose tissue between the newly formed sinuses.

While not frequently encountered, distended capillaries are occasionally seen lying between the internal and external elastic lamellae. These also may be followed through gaps in the internal elastic lamella to communicate with capillaries inside that layer.

The healed lesions thus resemble at first glance canalized thrombi. But it is clear when they are followed through their development that thrombosis does not occur at any stage. The resemblance is therefore only a superficial one. The fact that the circulation is at no time interrupted by thrombotic closure of the vessels explains the absence of infarcts in the lungs, even when the presence of an associated chronic passive congestion would favor their occurrence. Yet the interpolation of the cavernous tissue within the vascular tubes must bring about a slowing of the stream and probably results in stasis and congestion in the neighboring vascular channels.

The formation of new blood channels, as has been pointed out, seemingly depends upon an initial extravasation of red cells in the interstices between the fibrin strands. In some instances where this has not occurred, the development of new vessels fails to take place. In such a case, the exuded fibrin is gradually replaced by fibrillar connective tissue in which there eventually appear newly formed elastic fibrils. At this stage the picture simulates an obliterating endarteritis (Fig. 12).

The muscular coat in the larger arterioles is affected to a varying degree. In many instances, the muscle fibers virtually disappear, so that the internal elastic lamella when it has not undergone destruction comes to lie in close apposition to the elastica externa.

The fate of the peculiar inflammatory tissue which often forms a broad zone about the affected vessel is less easy to follow. Even in the more acute stages, many of the cellular components show degenerative changes, their nuclei being distorted and fragmented. Beyond that, it has not been possible to trace the process in detail. Presumably the wandering cells disappear. In our material there has not been observed, even in the healed lesion, great formation of scar tissue in the vicinity of the vessels.

Illustrative Cases

The following cases are chosen as exemplifying the lesions under discussion. A résumé of our material is given in abstract in Table I.

TABLE I

Autopsy no.	Age	Sex	Wassermann reaction	*Rheumatic history*			
				Tonsillitis	Arthritis	Cardiac	Chorea
9334	16	Male	o	+	–	+ Mitral stenosis and insufficiency	+ 10 years ago
9457	42	Female	o	–	+ "Growing pains" Polyarthritis, 3½ years ago	Heart trouble since childhood Mitral stenosis and insufficiency	–
9595	54	Female	o	–	–	Mitral stenosis and insufficiency Adherent pericardium	–
9626	33	Female	o	+	–	–	–
9627	9	Male	o	+	+ Frequent polyarthritis, first attack 4 years ago	Mitral stenosis Aortic insufficiency Pericarditis	–
9630	25	Male	o	+	+ Polyarthritis 2 years go	–	–
9636	47	Female	o	?	+ Polyarthritis First attack 10 years ago Admitted during second attack	+ Mitral insufficiency	–
9678	50	Male		?	+ Polyarthritis 10 and 3 years ago	+ Mitral stenosis	?
9680	9	Female		+	+ Polyarthritis 4 years ago	+ Mitral and aortic insufficiency	–
9691	68	Male	o	–	–	? Myocardial insufficiency	–

TABLE I

Lesions of rheumatic origin at necropsy	"Rheumatic" lesions of peripheral vessels	Other lesions	*Blood cultures*	
			Antemortem	Postmortem
Healed pericarditis Mitral stenosis	Pulmonary arterioles, acute and healing	Thrombus of right auricle Multiple infarcts of lungs Lobular pneumonia Fibrosis in lungs Chronic passive congestion of viscera	Negative (2)	Anhemolytic streptococcus (lung)
Mitral stenosis Rheumatic myocarditis (Aschoff bodies) Rheumatic aortitis	Bronchial and pulmonary arterioles, acute and healing Renal	Chronic passive congestion of viscera Myoma of uterus Hydrothorax Hydropericardium Ascites		
Adherent pericardium Rheumatic endocarditis, tricuspid, mitral and aortic valves Mitral stenosis Rheumatic myocarditis (Aschoff bodies)	Vessels about renal pelvis	Erysipelas Acute interstitial nephritis Acute splenic tumor Nodular cirrhosis of liver Lobular pneumonia Thrombi of left auricle	Negative	Negative
Rheumatic myocarditis (Aschoff bodies)	Ovarian Renal	Chronic nephritis Hypertrophy of heart		
Pericarditis Rheumatic endocarditis, mitral and aortic valves; left auricle Rheumatic myocarditis Rheumatic aortitis Aschoff bodies in diaphragm	Polyp of cecum	Chronic passive congestion of viscera Hydrothorax Ascites Polyp of cecum	Negative (3)	
Rheumatic endocarditis, mitral and tricuspid valves Myocardial fibrosis	Periadrenal fat	Lobar pneumonia Suppurative pleurisy	Pneumococcus I	
Rheumatic endocarditis, tricuspid, mitral and aortic valves Rheumatic pericarditis Rheumatic myocarditis (Aschoff bodies) Rheumatic aortitis	Perirenal fat Renal Aortic valve	Cholelithiasis Obsolete tuberculosis		
Rheumatic endocarditis, tricuspid, mitral and aortic valves Rheumatic myocarditis (Aschoff bodies) Rheumatic aortitis (Aschoff bodies)	Appendix epiploica of sigmoid	Thrombus of left auricular appendix Embolus of middle cerebral artery		
Rheumatic endocarditis (acute) Rheumatic myocarditis (Aschoff bodies) Rheumatic pericarditis	Perirenal fat	Subacute bacterial endocarditis Embolic nephritis Infarcts of spleen and kidneys		Anhemolytic streptococcus
Acute rheumatic myocarditis (Aschoff bodies)	Testis Pancreas	Thrombi of right auricle, and right and left ventricles Embolus of right internal carotid artery and right middle cerebral artery Infarct of brain		

CASE I. T. B., age 43, female (History No. 55714, Autopsy No. 9457, Dr. Butler). Admitted to Presbyterian Hospital in December 1922, and December 1923.

Past History. Acute rheumatic fever two and one-half years ago. Short of breath since childhood. Occasional precordial pain and palpitation for six years. No history of tonsillitis or chorea.

Present History. "Caught cold" four weeks before first admission. Fever, cough and malaise.

Physical Examination. Many coarse and fine râles in both lungs. Heart enlarged; soft systolic and a rough early diastolic murmur over entire precordium, loudest at apex. Pulmonic second sound accentuated. Liver edge 6 cm. below costal margin. Wassermann negative. Red blood cells, 3,500,000; white blood cells, 7,100; polymorphonuclear neutrophiles 86 per cent.

Discharged after three weeks with diagnosis of chronic bronchitis and chronic cardiac valvular disease (mitral stenosis and insufficiency).

Readmitted in December 1923, with history of bronchitis for ten days. Edema of legs.

Physical Examination. At that time, small areas of dullness and bronchial breath sounds near bases with coarse râles. Heart enlarged to right and left. Diastolic thrill at apex with systolic and diastolic shock. Rough rumbling diastolic murmur at apex and soft blowing systolic murmur, transmitted to axilla. Blood pressure 125 systolic and 68 diastolic. Lungs, dullness at apices with wheezing respiration. Small areas of dullness near bases with bronchial voice and diminished breath sounds. Coarse râles throughout lower two-thirds of both lungs. Liver edge 4 cm. below costal margin in midclavicular line. Shifting dullness in flanks with fluid wave. Extremities, marked edema of legs and ankles. Red blood cells, 3,600,000; hemoglobin, 80 per cent; white blood cells, 20,000; polymorphonuclear neutrophiles, 92 per cent.

Patient died on the second day after admission.

Clinical Diagnoses: Bronchopneumonia; chronic cardiac valvular disease (mitral stenosis and insufficiency); chronic bronchitis.

Necropsy. Anatomic Diagnoses: Chronic cardiac valvular disease, rheumatic (mitral stenosis); rheumatic myocarditis; cardiac hypertrophy and dilatation; hydropericardium; hydrothorax; ascites; edema of extremities; chronic passive congestion of viscera; acute arteritis, pulmonary arteries; fibromyoma of uterus.

Only the heart and lungs need to be described. The remaining viscera showed no lesions bearing upon the condition under discussion. Heart weighs 310 gm. Epicardium smooth. Right ventricle hypertrophied. Free edge of tricuspid valve thickened and opaque but without definite vegetations. Pulmonic valves normal. Left auricle dilated and hypertrophied. Auricular endocardium wrinkled above posterior leaflet. Mitral valve leaflets are shortened, thickened and calcified, projecting at right angles to blood stream. They are adherent to each other. Mitral orifice reduced to a buttonhole slit 14 mm. long. At two points the valve is ulcerated over calcium deposits. Chordae tendineae are thickened and shortened. Papillary muscles hypertrophied. Aortic cusps slightly thickened at their bases. Coronary arteries are normal. Myocardium shows no gross scarring.

Histologic Examination. Mitral valve: Greatly scarred with irregular hyaline masses of connective tissue and deposits of calcium. No bacteria are present in the Gram stain. *Myocardium:* Blocks from left ventricle are negative. A section taken through interventricular septum shows in the neighborhood of a

small coronary artery a few fusiform cells with vesicular nuclei, distinct nucleolus and purplish cytoplasm. There is fragmentation of collagen fibers in the vicinity of these cells. The appearances suggest a small Aschoff body. No scars are present. *Lungs:* Right lung weighs 500 gm. Lung is air-containing. On section it is reddish gray. Cut surface bathed in bloody fluid. Lower lobe contains numerous reddish areas which are relatively firm. Bronchial mucosa congested. Large branches of pulmonary artery project above cut surface. Alveolar septa thickened. No consolidation. Left lung weighs 400 gm. and presents same appearance.

Microscopic Examination. The most interesting changes are in the arterioles of microscopic dimensions. Practically no normal vessels are found. The lesions conform to those described and are illustrated in Figs. 2, 3, 7, 8, 9 and 12. All stages, from the subendothelial exudation of fibrin to final organization with development of new blood channels, may be seen.

There is no pneumonic exudate in the alveoli, but moderate edema and occasional fibrinous coagulum and desquamated cells are seen. There is congestion of the capillaries, but most intense about the affected arterioles. The pulmonary veins are normal.

The remaining viscera show only the changes of chronic passive congestion.

CASE II. E. H., age 47, female (History No. 62745, Autopsy No. 9636, Dr. Paige). Admitted to Presbyterian Hospital April 28, 1925, and died April 30, 1925.

Chief Complaints. Pain in left side for three weeks, multiple arthritis for two weeks, shortness of breath for ten years and hematuria for four days.

Past History. Acute rheumatic fever ten years ago. Increasing shortness of breath for three years. Influenza six months ago.

Present Illness. History vague and conflicting. The main points are (1) a known cardiac lesion; (2) polyarticular pain with fever for two weeks; (3) dyspnea; (4) hematuria for four days; (5) irregular menses; (6) headache. Has been irrational for three days.

Physical Examination. Obese woman, irrational. No petechiae. Suprasternal pulsation. Heart, considerably enlarged to left. Maximum impulse diffuse; heart sounds of fair quality, regular. Blowing systolic murmur heard over entire precordium, loudest over second right interspace. Blood pressure 170 systolic and 60 diastolic. Lungs dull at base; scattered moist râles. Abdomen, no masses felt. Right wrist somewhat reddened. No edema of extremities or clubbing of fingers. Red blood cells, 4,200,000; white blood cells, 24,800; polymorphonuclear neutrophiles, 90 per cent. Blood culture, sterile. Blood urea, 0.98 gm. per liter. Blood Wassermann, negative. *Urine:* specific gravity, 1.026; neutral; albumen, heavy trace; acetone present; many casts, epithelium and white blood cells; no red blood cells. Temperature 102.4 F; pulse 100; respiration 28.

Course. Eight hours after admission condition worse. Wildly irrational, then comatose. Râles in chest increased. Temperature gradually rose, death occurring in coma with temperature of 107.4 F.

Clinical Diagnoses: Acute rheumatic fever; chronic cardiac valvular disease (mitral insufficiency); cardiac hypertrophy; hypertension.

Necropsy. Anatomic Diagnoses: Rheumatic endocarditis (tricuspid, mitral and aortic valves); rheumatic pericarditis, fibrinous; acute rheumatic myocarditis; rheumatic aortitis; cardiac hypertrophy; chronic passive congestion of

liver, spleen and kidneys; edema of pia and lungs; focal necroses of liver; obsolete tuberculosis (right lung); cholelithiasis; melanosis of colon.

The lesions in this case bearing on the subject were in the heart and kidneys.

Heart weighs 500 gm. External surface and parietal pericardium covered with thick layer of fibrin, except over the posterior surface of the left ventricle. Many subepicardial hemorrhages. Myocardium pale and soft. No scars. Tricuspid valve irregularly thickened, with fusion of anterior and posterior leaflets. Pulmonic valve normal. Wrinkling of endocardium of left auricle above posterior leaflet of mitral valve. Mitral valve thickened, with tiny verrucae 1 to 2 mm. in size, of yellowish gray color along line of closure, and extending down to edge of valve and to insertion of chordae tendineae. Some of the chordae are slightly thickened. Papillary muscles hypertrophied. Aortic leaflets are thickened and have on them minute dull grayish yellow vegetations.

Histologic Examination. Recent fibrinous pericarditis without organization. Section of mitral valve shows characteristic rheumatic vegetations composed of hyaline material with ingrowing fibroblasts. Aortic valve also has characteristic vegetations; in its substance is a capillary, the wall of which is obscured by fibrinous infiltration. There is no great accumulation of cells about it.

Myocardium contains numerous Aschoff bodies and periarterial scars. (Culture of pericardial fluid sterile.)

Aorta in gross showed early atherosclerosis. Microscopically, there are scars about the nutrient vessels.

Kidneys, each weighs 110 gm. Identical in appearance. Normal on section save for congestion of vessels. Microscopically, no significant changes are found in the renal parenchyma. The arterioles and capillaries in the peripelvic fat and in the contiguous tissue of one kidney show an acute arteritis of the type described (see Figs. 4 and 10). There is necrosis and infiltration of all coats, but no suppurative changes. No thrombosis.

The viscera show no lesions of particular interest.

Discussion

One may advance the following arguments in favor of the rheumatic origin of these vascular lesions.

1. They have been invariably associated with undoubted cases of infection with the rheumatic virus and have not, in our experience, been found in any case which did not show rheumatic lesions.

2. The finer histologic features are in many respects analogous to those present in the rheumatic lesions of the left auricle, as described in the recent paper by VonGlahn.[2] Particularly in the reactive tissue about the vessels there is the same peculiar combination of elongate and distorted nuclei, eosinophiles and fragmented polymorphonuclears.

3. The lesions have a specific character and do not coincide with any hitherto well defined type of vascular disease. They perhaps most closely resemble those of periarteritis nodosa, but the following

differences may be noted: (*a*) In periarteritis nodosa, thrombosis is of frequent occurrence; this has not been seen in any instance in the rheumatic cases. (*b*) Periarteritis nodosa commonly affects arteries of medium caliber. In the cases above described the smaller arteries as well as those of medium caliber, arterioles and sinusoidal capillaries have been affected. (*c*) The inflammatory changes in periarteritis nodosa lead, as the name indicates, to nodule formation often of macroscopic dimension and frequently to the development of aneurysm and infarcts. The "rheumatic" lesions are not nodular and invariably are microscopic. Though the affected vessel may show slight dilatation, this is never sufficiently localized or sufficiently marked to justify description as an aneurysm. Nor, for the reason already discussed, do the "rheumatic" lesions lead to infarction or hemorrhages from rupture. The cellular components of the reactive tissue differ from those in periarteritis nodosa. In the rheumatic lesions, eosinophiles are not abundant; in periarteritis nodosa they are often the most conspicuous cellular element. Plasma cells also are not numerous in the rheumatic lesions; they are of frequent occurrence in the other.

The lesions bear even less resemblance to those occurring in the course of acute pyogenic infections. The absence of bacteria, of thrombus formation and of a typical suppurative reaction is sufficient to exclude vascular lesions of this category.

Review of Literature

It is most interesting that a localization of the rheumatic virus in peripheral vessels should have been surmised for many years. The term "rheumatic arteritis" dates back to the well known treatise of Bouillaud (1840),[3] and clinical cases purporting to illustrate this condition have been cited by Lemaire (1864),[4] Fernet (1865),[5] de Fajole (1866),[6] Lelong (1869),[7] Lecorché (1869),[8] Guéneau de Mussy (1874),[9] Legroux (1884),[10] Huchard (1892),[11] Hanot (1894),[12] Brault (1896),[13] Astier (1897),[14] Blot (1898),[15] Besson (1900),[16] Barié (1905, 1913)[17] and Queuille (1906).[18] In spite of their suggestive titles, little definite information can be extracted from these papers. For the most part, they are reports of clinical cases in which violent pulsation of the larger peripheral arteries attracted attention. The few necropsy reports and the still rarer histologic descriptions of the

larger vessels are too indefinite to justify analysis. A good summary of the French literature is to be found in the paper of Barié (loc. cit. 1913).

A few references, equally indefinite, are to be found in the German literature. Thus Wiesel and Löwy (1919) [19] in a paper upon the effects of acute and chronic circulatory insufficiency upon peripheral blood vessels, made the following statement (p. 1085): "Acute rheumatic fever likewise is accompanied not only by endocardial, but also by arterial lesions." * No specific changes are described. In a recent paper (1923), Wiesel [20] again alludes to the effect of rheumatism, as well as other infectious diseases, upon the peripheral arteries. Here he mentions changes in the media as a factor leading to juvenile arteriosclerosis. Fahr (1920) [21] is inclined to attribute to rheumatism, in addition to lues and lead, etiologic importance in the production of "malignant sclerosis" of the kidney. He cites five cases in which renal disease followed at varying intervals a rheumatic infection. No reference is made to distinctive vascular lesions. In a subsequent paper (1921),[22] Fahr again refers to rheumatic affections of the small renal arteries as a probable cause of malignant renal sclerosis. This paper contains a low-power photomicrograph of periarterial granulomatus formation with lymphoid cells, fibroblasts and occasional eosinophiles. The details are difficult to distinguish, but it is possible that the lesion pictured is identical with that described by us.

In the English and American literature no definite allusions to rheumatic arteritis have been found. However, it is not surprising to discover that Mallory,[23] who has interested himself particularly in infectious lesions of blood vessels, should have given in his textbook a most accurate reproduction of the type of lesion under discussion. The vessel involved was situated in the kidney, but there is nothing in the legend or text to indicate whether or not the case was one of rheumatic fever.

Ophüls,[24] in his discussion of the etiology of periarteritis nodosa, emphasizes the apparent close relationship between this disease and the "ill-defined group of subacute and chronic 'septic' conditions, with so-called rheumatic symptoms, and frequently associated with endocarditis." While it is possible that certain cases of rheumatic vascular disease may have been interpreted as periarteritis nodosa,

* "Auch die akute Gelenksrheumatismus ist . . . nicht nur von Erkrankungen des Endokards, sondern ebenso von solchen der Arterien begleitet."

there are, as has been pointed out, very clear-cut differential features. The final decision as to whether these two somewhat similar conditions are related, must be deferred until the cause of each is known.*

Conclusions

In a series of forty-seven consecutive cases of rheumatic cardiac disease, specific lesions of the small peripheral arterioles and capillaries, either systemic or pulmonary, have been found in ten.

These lesions are characterized by the exudation of fibrin into and about the vessel, by destructive changes in the cellular components of the vessel wall, by a distinctive cellular reaction in the adjacent tissue and by the absence of thrombosis.

These acute lesions are followed by organization with or without formation of new collateral channels within the thickened intima and occasionally within the muscular layer.

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* There has come to our attention since this paper was submitted for publication, an article by Baehr and Sacks (*Proc. New York Path. Soc.*, 1923, xxiii, 64). They described vascular lesions of the renal arterioles in cases of glomerulonephritis associated with verrucous endocarditis, three of which were regarded as typically rheumatic, and two as belonging to the "atypical form" described by Libman and Sacks.

In the mildest form of involvement, the changes . . . "consisted of endothelial swelling and proliferation. In the more severely damaged arterioles, there was irregular hyaline degeneration and necrosis of the normal elements of the vessel wall, with karyorrhexis of many of the nuclei, infiltration at times with polymorphonuclear and round cells, and the deposition of fibrin and blood platelet thrombi in the lumen. These changes were often limited to the vasa afferentia close to the pedicle of the glomerulus; in other instances they extended as far as the terminal segments of the interlobular arteries. Some of the arterioles showed thrombus deposition with comparatively little inflammatory change in the vessel wall."

The authors are undecided whether these cases constitute a specific infection with an endotheliotropic virus, unusual forms of rheumatic fever or are related to the atypical group of endocarditis of Libman and Sacks.

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DESCRIPTION OF PLATES

PLATES 41–46

FIG. 1. Autopsy No. 9680. Arteriole in fat near pelvis of kidney. Exfoliation of endothelium and necrosis of vessel wall with fibrinous exudation. Marked inflammatory reaction in adjacent tissue. Congestion of surrounding capillaries. (Hematoxylin-eosin stain.)

FIG. 2. Autopsy No. 9457. Pulmonary arteriole. Fibrinous exudate beneath endothelium. Stretching and beginning fragmentation of internal elastic lamella. Thinning of muscular coat. Slight inflammatory reaction in surrounding tissue. No thrombus formation. (Weigert's elastic tissue-hematoxylin-eosin stain.)

FIG. 3. Autopsy No. 9457. Pulmonary arteriole. Dense accumulation of fibrin beneath endothelium with small masses in muscular coat. (Gram-Weigert-safranin stain.)

FIG. 4. Autopsy No. 9636. Arteriole in column of Bertini of kidney. Fibrin beneath endothelium, in vessel wall and ramifying into surrounding tissue. (Gram-Weigert-safranin stain.)

FIG. 5. Autopsy No. 9626. Sinusoidal capillary in wall of ovarian cyst. Necrosis of vessel wall with fibrinous exudate. Peculiar type of avascular inflammatory tissue surrounding the vessel. (Hematoxylin-eosin stain.)

FIG. 6. Inflammatory tissue in wall of left auricle in rheumatic endocarditis. (Reproduced from "Endocarditis of rheumatic origin," VonGlahn, Fig. 10, Am. J. Path., 1926, ii, 1.) Compare character of cell reaction with that shown in Fig. 5.

FIG. 7. Autopsy No. 9457. Pulmonary arteriole. Acute lesion in cross-section and healing state in portion of vessel cut longitudinally. Zone of capillary congestion about affected vessel. (Wiegert's elastic tissue-hematoxylin-eosin stain.)

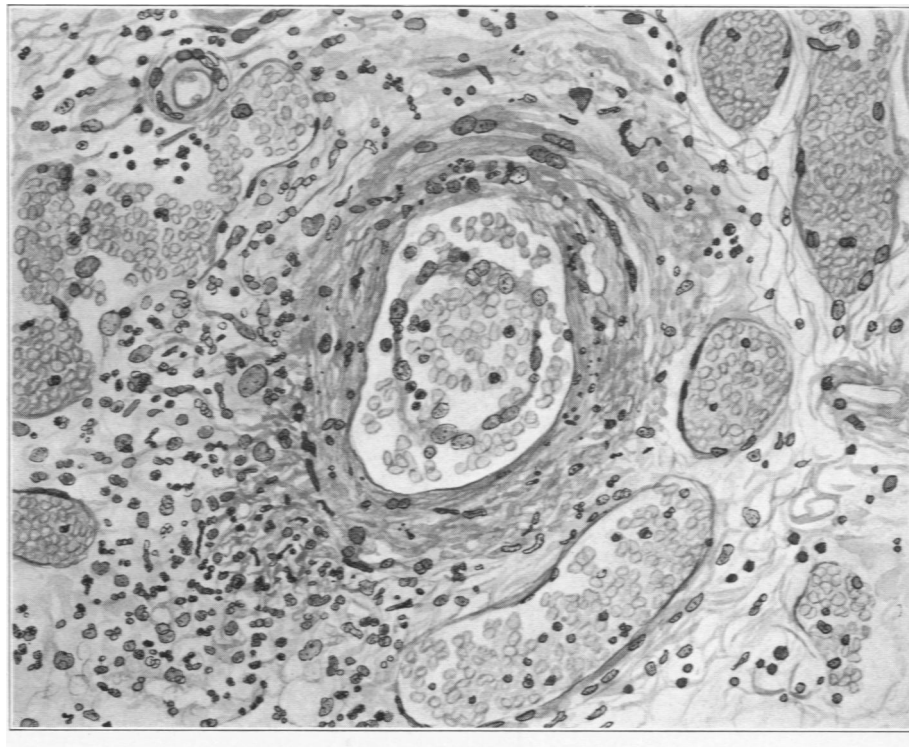
FIG. 8. Autopsy No. 9457. Pulmonary arteriole. Late stage, longitudinal section of vessel. Lumen occupied by distended capillaries surrounded by loose connective tissue. The elastic lamella has remained intact. (Weigert's elastic tissue-hematoxylin-eosin stain.)

FIG. 9. Autopsy No. 9457. Pulmonary arteriole. Cross-section. Changes same as in Fig. 8. (Weigert's elastic tissue-hematoxylin-eosin stain.)

FIG. 10. Autopsy No. 9636. Arteriole in column of Bertini of kidney. Necrosis of vessel wall with fibrinous exudate. Necrosis of elastic lamella. Note zone of capillary congestion about affected vessel. (Weigert's elastic tissue-hematoxylin-eosin stain.) Same vessel as shown in Fig. 4.

FIG. 11. Autopsy No. 9691. Arteriole in testis with internal elastic lamella almost completely destroyed. A portion of it persists immediately near upper margin of original lumen. Another fragment is seen below separated from lumen by large mass of fibrin; a few fragments remain also of the external elastic lamella. The fibrinous mass contains a number of large basophilic branching cells with one or several nuclei. There is also a newly formed blood channel. Lesion shows repair. (Weigert's elastic tissue-hematoxylin-eosin stain.)

FIG. 12. Autopsy No. 9457. Pulmonary arteriole. Healed stage without vascularization of fibrinous exudate. In this stage the vessel presents the picture of obliterating endarteritis. Two fragments of the internal elastic lamella are shown marking the limits of the original intima. (Hematoxylin-eosin stain.)



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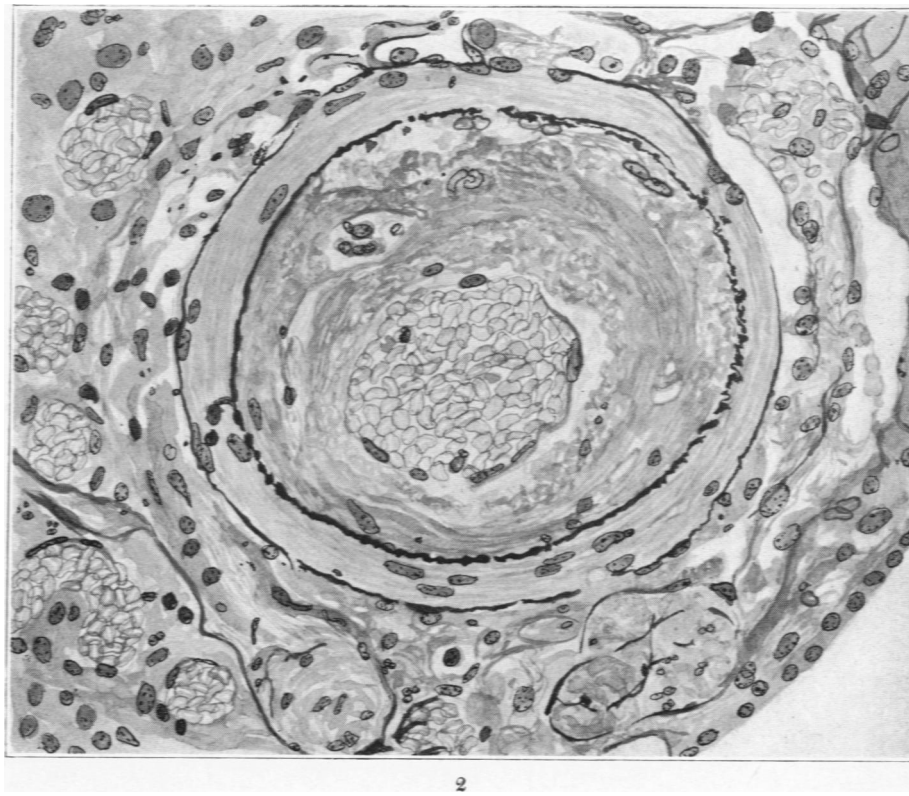

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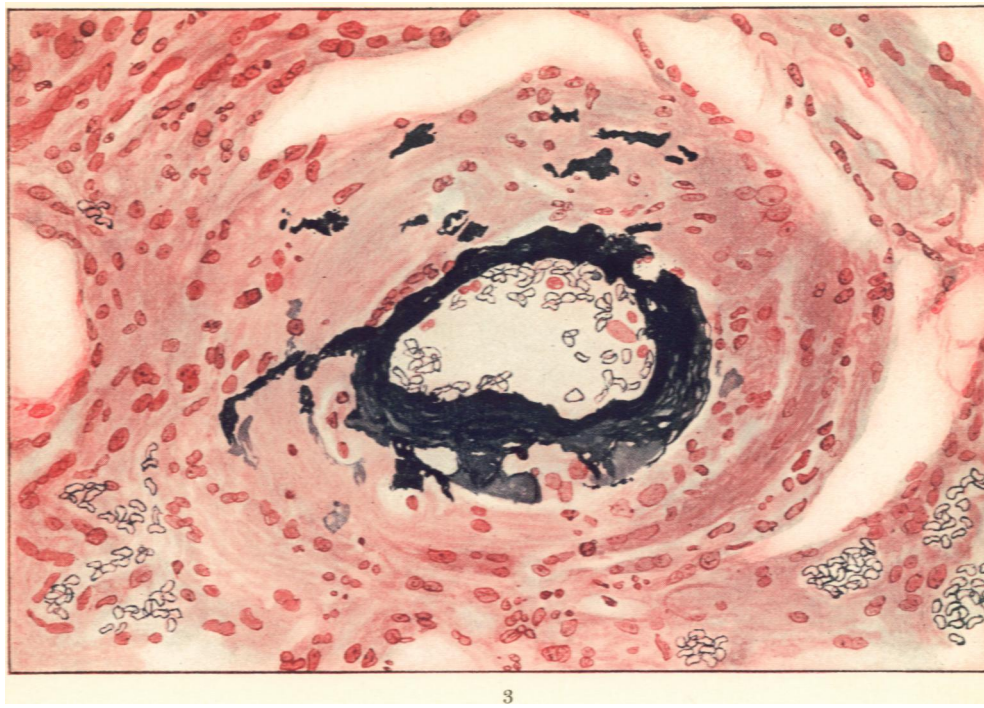

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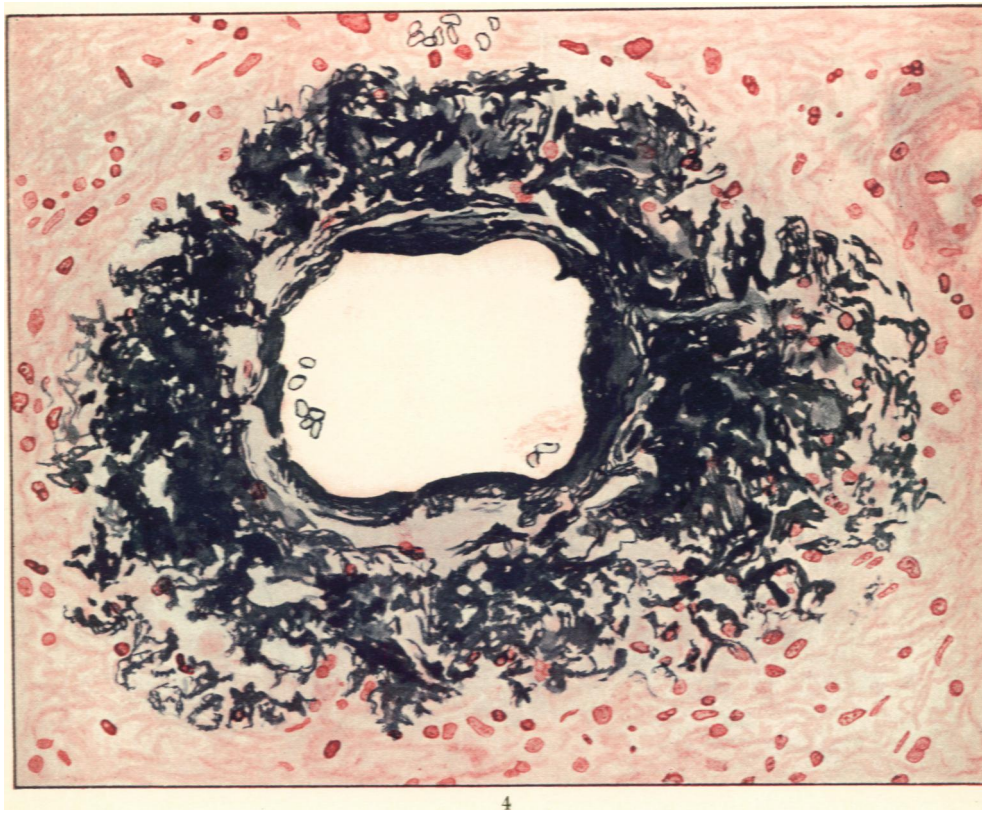

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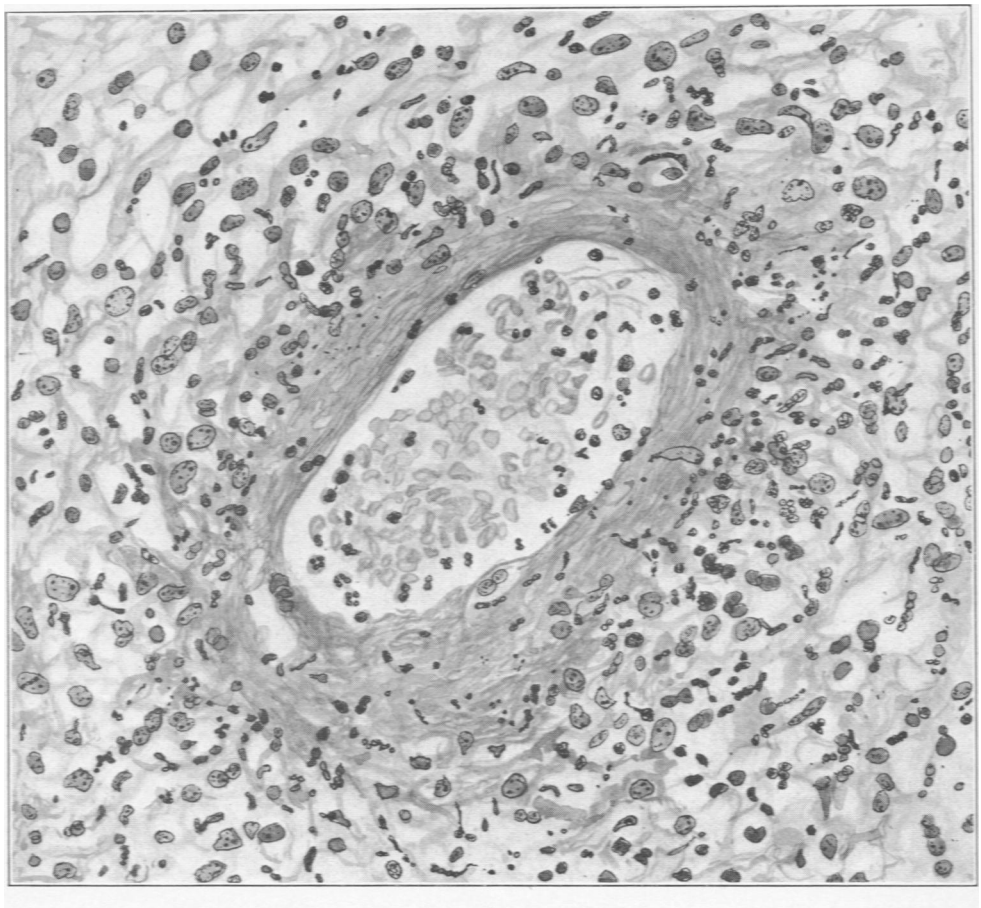

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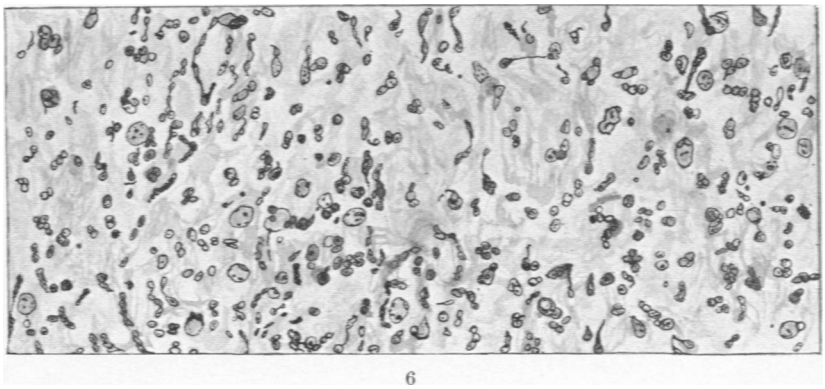

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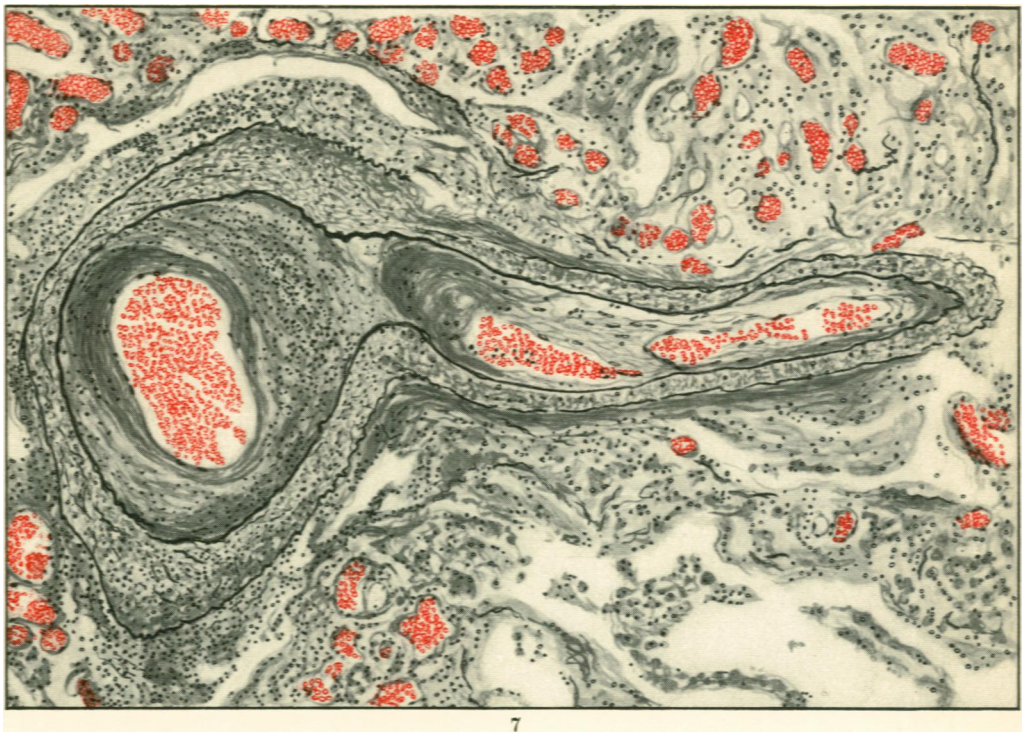

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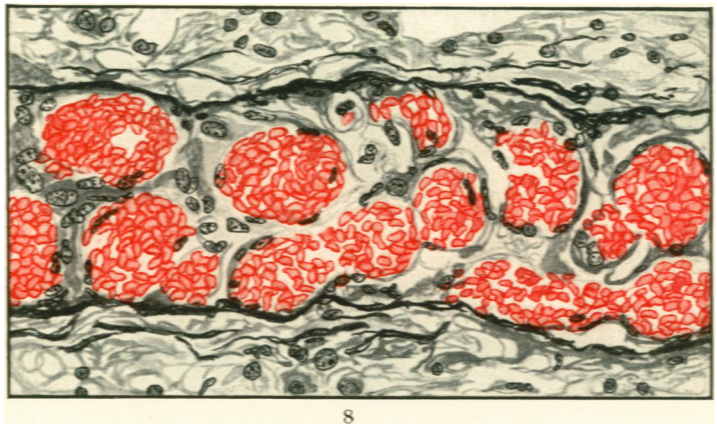

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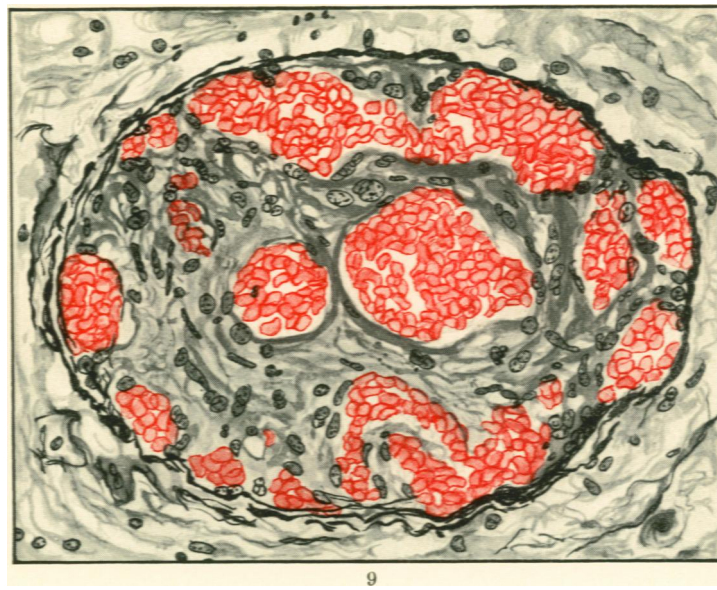

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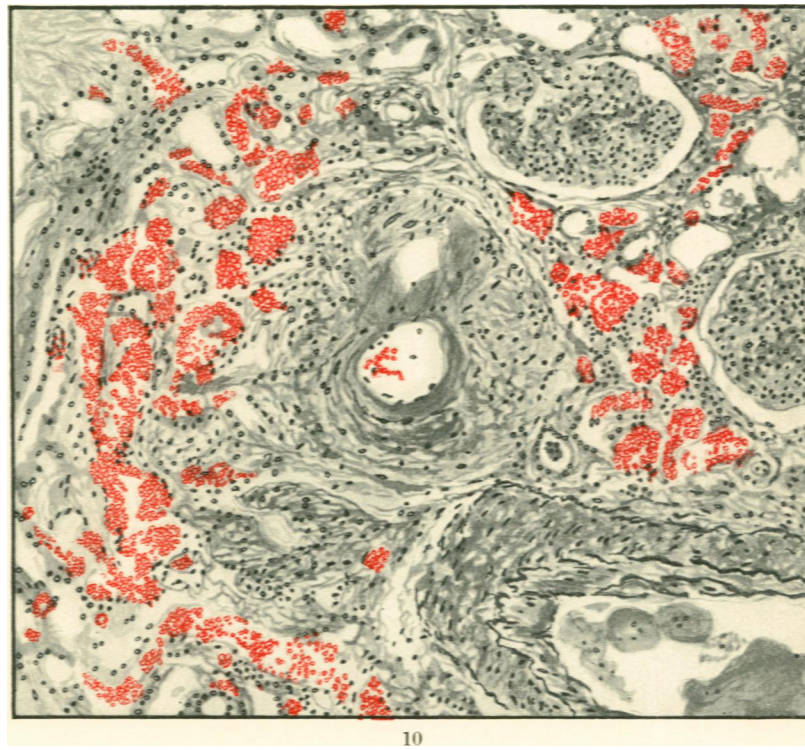

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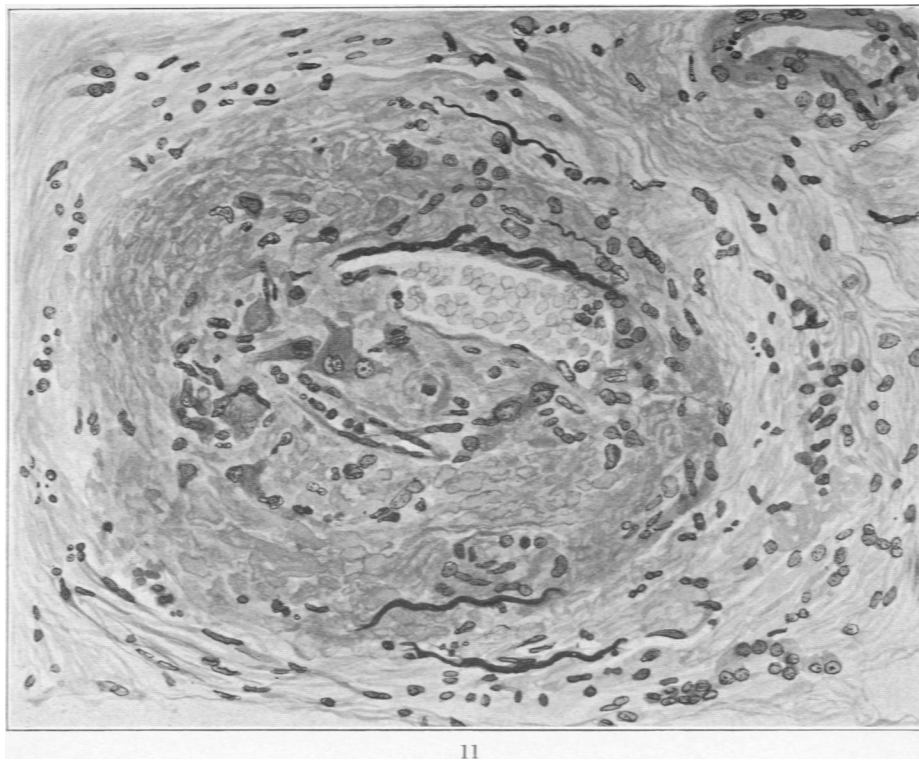

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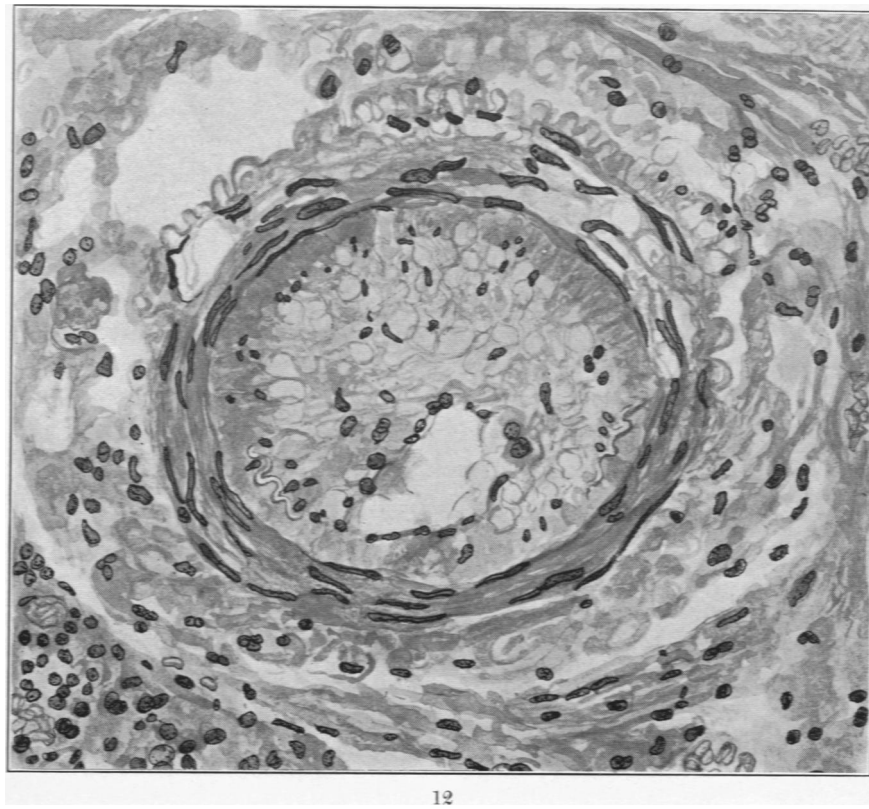

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