

However, in each instance the muscle fibers are primarily affected. These lesions, it is obvious, have destroyed the most important tissues in the artery, and have weakened the vessel wall very considerably. Aneurisms are commonly to be found at the sites of medial change while little if any intimal compensation occurs. Thoma's dictum, therefore, that intimal compensatory hypertrophy follows medial weakening is not universally true. This type of arterial disease, in which the media is first destroyed, is spoken of as "Moenckeberg's arteriosclerosis."

Not alone was the medial degeneration with calcification produced by means of drugs, but I have also obtained it by the inoculation of the diphtheria toxin. This is important in demonstrating that the effects of diphtheria are not confined to nervous tissue and heart muscle, but that the muscle elements of the vascular system are also attacked. It may be that the intoxication in cases of diphtheria is an important agent in bringing about Moenckeberg's arteriosclerosis, such as is seen in the radials and other peripheral vessels.

This latter form of medial degeneration with aneurismal pouchings has also its analogy in the peripheral arteriosclerosis in man. The greater majority of the cases of arteriosclerosis which are diagnosed from the condition of the radial arteries are of this type. The beadings so often noted in the radials of old people are the small pouchings in the vessel wall that have become calcified.

It is therefore evident that if the term arteriosclerosis is to be retained for the use of the clinician that this form of arterial disease, which is most commonly seen at the bedside, must be included under it.

The calcified plaques of the aorta or the calcareous beadings in the radials and other peripheral vessels are in each case secondary to a previous fatty change of the tissues. Experimentally these deposits of lime have been produced in connection with the medial destruction, when both muscle and elastic fibers become fatty. It is interesting to trace the course of the muscle tissue through the process of fatty degeneration with a subsequent death of the cells. The fine fat droplets within the cells are converted into the fatty acids by the lipase of the blood and serum, following which the salts of lime form a stable compound with the fatty acid in the form of lime soaps. These fatty acids and soap compounds are readily demonstrable by special staining. From the calcareous soaps the phosphate and carbonate of lime become deposited later.

Thus, up to the present, we have at our command the production of three types of arteriosclerosis, namely, (1) endarteritis chronica deformans, (2) mesarteritis, (3) Moenckeberg's type of arteriosclerosis. Each of these experimentally produced arterial diseases follows the same course and has the same ultimate result as in man. However, as the lesions are produced in healthy animals, which have power to com-

pensate the effect of extreme arteriosclerosis, fewer symptoms are to be noted. The heart rapidly becomes hypertrophied and is able to carry the new load with comparative ease.

VISCERAL ARTERIOSCLEROSIS.*

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PHYSIOLOGY has taught us that all the tissues of the body are dependent, either directly or indirectly, on their blood supply. From our pathological investigations we recognize that when the amount or character of this nutriment is decreased the tissues begin to degenerate and become diseased then a decrease in function results. When this takes place in a single organ, or in a group of organs, the demands of the other viscera being at their normal, symptoms of deficiency on the part of the diseased viscus become all the more prominent on account of the lack of correlation. If the decrease in nourishment, on the other hand, be a general one, as normally present in senility, none or few visceral symptoms appear, since the functions and requirements of the various diseased organs are equally diminished and the balance of relative visceral activity is not disturbed. Furthermore, with the general body requirements at the normal, a crippled system is regularly called upon to do the work of an otherwise natural body, and this normal and constant demand on the diseased viscera tends more and more in many cases to encompass progressive pathological changes.

Partly on account of this general law, visceral arteriosclerosis is clinically of very much more importance than the disseminated disease, at least in the body of an active growing or adult subject, and, as a rule, the symptoms of localized disease are more striking. For very much the same reason cases of general arteriosclerosis where the larger vessels, as the aorta, the femorals, axillaries and other general trunks, are mostly affected, present few or no general or specific symptoms, except in the presence of active disease, as an acute aortitis. This is due to the fact that the distribution of the nutritive fluid does not depend on the action of these large trunk walls, for their lumen is generally constant. This is so because their media or muscle coat is slight and the vessels are constructed for the most part to withstand pressure. Their condition does not act materially on the blood pressure and even when their lumen may be considerably encroached upon, the distribution of the blood is but slightly unbalanced, except in most unusual instances. As you all know, even when aneurisms of the large trunks are present, little or no disturbance of the nutritive function may appear and changes in general blood pressure are usually slight. Quite a contrary condition of affairs results when the trunks supplying the important viscera are involved.

* Read before the Medical Association of the Greater City of New York, Jan. 21, 1907.

The visceral arteries are those of the "medium" class as classified by the histologists, they are the trunks which have thick and well developed muscle coats. This heavy media is physiologically necessary since the blood supply to these organs must alternately be increased by the relaxation of the muscle and decreased during the physiological resting stage by the local contraction of this coat. As a result of this delicately balanced function, even relatively slight changes in any of the walls of these very active vessels hinder or limit the possibilities in these directions. Thus an alteration in the intima, even if it do not, as in most cases, also extend to the media coat, causes an appreciable alteration in the caliber of the vessel when it contracts or expands. Most important of all, when the media or muscle coat becomes even slightly diseased, either by degenerative muscular alterations, by encroachments of interstitial hyperplasia or by true inflammatory exudate, the physiological relaxation and contraction, the entire control of nutritive vascular supply is interfered with and the organ may, as a result, become chronically congested, or perhaps habitually anemic. In either case the viscus becomes permanently damaged and is no longer able to properly maintain its functions and its physiological balance in the interrelations of the body. A disturbance of this equilibrium leads first to secondary changes in the immediately dependent organ and perhaps finally to lesions of the general viscera.

Furthermore, disease of the arterial walls in vessels of this class tends to alterations in the general blood pressure, probably in an attempt on the part of the body by an increase in the pressure to balance the blood distribution or to furnish a normal requisite amount of blood for the functional activity of the diseased organ, especially if it be of great vital importance as is the case with the heart or kidney. Elevation of the blood pressure, due apparently to local arterial disease, is particularly well illustrated in cases of arteriosclerotic or small, contracted kidney where the blood pressure is almost uniformly elevated, a fact for the full recognition of which we are chiefly indebted to Dr. Janeway.

As to the relative rate of occurrence in visceral arteriosclerosis analysis of my series of 400 cases of arteriosclerosis showed 368 in which the visceral arteries were mostly or exclusively involved.¹ This rate of occurrence in itself demonstrates the importance of the consideration of the disease of these vessels. Analysis as to the relative distribution showed the coronary artery diseased in 270 of the 368 cases; the cerebral vessels were involved in 107 instances, the renal vessels in 81 cases, the pancreatic in 74, the hepatic in 43, the splenic in 35 and the spinal vessels in 20 cases, the pulmonary in 16, the celiac and its visceral branches in 19 and the mesenterics in 4. I urge these statistics as of special value to New York physicians, since they have been compiled exclusively from cases residing in this city, therefore subjected to its

general and local etiological conditions, also to the strain and wear of New York professional, business and laboring life.

Dr. Fisher, who was to have presented one of the aspects of visceral arteriosclerosis (as it occurs in connection with the nervous system), has unfortunately been prevented from favoring us to-night, but in general it may be stated that the symptoms of arteriosclerosis of any organ are practically those ascribed to the brain and cord. Thus we have temporary aphasia of the pancreas, not manifested by loss of speech, of course, but by loss of the pancreatic equivalent for speech, namely the pancreatic secretion. We have intermittent claudication of the renal vessels; and those of you who follow your kidney cases carefully, especially as to the relative amount of renal excretion, are, I am sure, able to fully corroborate this statement. Nearly every other symptom can also be likewise compared as to character and causation.

Very briefly the most constant symptoms of visceral arteriosclerosis in any organ are, (a) depressed function, often spasmodic, but mostly evident when studied for long periods, (b) pain, also usually spasmodic and always of the anginal character, localized in the distribution affected and exemplified by that seen in angina pectoris, erythromelalgia and Reynaud's disease, (c) also spasmodic elevation of blood pressure is an important but inconstant symptom.

Our diagnosis must as yet rely chiefly on the appearance of these symptoms coupled with a requisite history of etiological factors and the usual method of diagnosis of general arteriosclerosis (largely by the inspection and palpation of the superficial arteries which are, as I have formerly stated, most unreliable in visceral arteriosclerosis). Thus in my 400 cases the superficial vessels were involved but 154 times, and in 4 of these instances changes were not present to any appreciable degree in the internal visceral trunks, but were found only in the superficial vessels. Thus peripheral and oftentimes quite general arteriosclerosis may exist without involvement of the nutritive vessels of the important organs.

I am intensely interested in the treatment of visceral arteriosclerosis and, notwithstanding the very short time allotted to my paper, I cannot refrain from mentioning some of the methods which have proven most efficient in my hands.

First, we must mention those measures which tend to eliminate the productive factors; this primarily involves in most cases the relief of the diseased viscus from overfunctional activity; if the brain, the patient must be relieved from worry and stress, if the pancreas or liver, from excessive digestive demands, and if the kidney vessels are chiefly diseased elimination by other routes must be substituted, and the products for elimination simplified by the correction of diet or relief of metabolic disorders. In all instances general hygienic measures are to be insisted upon.

Diminution of the physiological or pathological demands on the diseased organ may be occa-

¹ Transactions New York Academy of Medicine, Feb. 15, 1906; Amer. Jour. Med. Sc., May, 1906.

sionally encompassed by the proper exhibition of drugs, or by local mechano-therapy. Thus, in coronary arteriosclerosis the use of the various vaso-dilators or of the warm or CO_2 bath may give, as you all know, gratifying results.

General treatment is attended by benefit in nearly all instances. Thus the general lowering of the blood pressure when it is habitually high, either by local or general means, is often necessary. Potassium iodide and perhaps other forms of iodide as well, employed as general drugs, serve to prevent extension of the disease, as definitely shown by recent experiments; and also, in at least a certain class of cases, it tends to facilitate absorption of inflammatory and degenerative products in the vessel walls already diseased. This action of the iodides no doubt takes place quite independently of syphilitic disease, in which instance, of course, we all recognize the utility of the drug and that of its companion, mercury.

In conclusion, permit me to especially urge upon you the following points: First, the great frequency of visceral arteriosclerosis and its importance, particularly in internal medicine. Second, the diagnoses, in many cases partly by exclusion, partly by its direct signs and symptoms and partly by the results attending treatment. Third, treatment which is attended with great benefit in a very considerable number of cases, but which must first be based on a close study of the special etiology, on a thorough appreciation of the physiology of the diseased organs and of the special idiosyncrasies of each instance and, finally, on a correct diagnosis.

Medical Progress.

RECENT PROGRESS IN GYNECOLOGY.

BY W. L. BURRAGE, M.D.

THE INNERVATION OF THE UTERUS.

The uterus up to the last few decades has been described in the textbooks as having no nerves in its tissues, notwithstanding the fact that it is the seat of much pain both in the pregnant and non-pregnant condition, it is sensitive to intra-uterine instrumentation, and, moreover, the causative agent of the condition known as hyperemesis gravidarum. Nerves had not been demonstrated in the muscles or mucosa.

That nerve ganglia and nerve trunks existed in the tissues immediately surrounding the uterus had long been known. Their exact description, more particularly the description of the cervical ganglion, was left to Ph. Jung to demonstrate.¹ He published in 1905 an article on the innervation of the female genital organs previously noted in these columns.²

His plates show a cervical ganglion, half moon shaped, situated in the connective tissue of the parametrium of a full term infant. It lies at about the level of the vaginal fornix, laterally at

a considerable distance from the uterus, not far from the ureter. There are many nerves radiating from this ganglion in all directions. Jung thinks that the ganglion represents a conglomeration of all the branches of the genital nerves and is not a true plexus. Great masses of ganglion cells and connective tissue make up its substance. He also demonstrated what he considered to be nerve ganglia in the posterior wall of the uterus of a newborn child. Later investigations have not confirmed him in this interpretation of what he found, however.

Alf. Labhardt³ has conducted investigations on the uteri of animals and women in the Woman's Hospital of the city of Basel and the Physiological Laboratory of the University of Basel, embodying his results in an exhaustive article of seventy-six pages, five colored figures and one hundred and thirty references to the literature.

He set himself the task of answering the following questions: "How do the nerve fibers run in the uterine tissue?"

"How do the fibers end in the myometrium and how in the mucous membrane?"

"Are there ganglion cells in the substance of the uterus?"

Before discussing and answering these questions he reviews the literature as to the origin and the course of the nerves reaching the uterus, concluding with the following statement:

"The uterus receives sympathetic nerve fibers as well as those which arise from the cerebro-spinal system. The sympathetic fibers, to which branches are given by the solar ganglion, run downward in the aortic plexus. In its downward course the aortic plexus receives auxiliary branches from the lumbar ganglion of the sympathetic.

"At the point of bifurcation of the aorta, the aortic plexus divides and becomes the two hypogastric plexuses, which surround the rectum and give off branches to it as well as to the other organs of the true pelvis. These hypogastric plexuses receive in turn auxiliary branches from the sacral ganglia of the sympathetic. As concerns the uterus, single branches run direct on each side from the hypogastric plexuses to the uterus, but other branches — and these make the majority — lead to the cervical ganglia, which lie to the right and left between the layers of the broad ligaments midway of the length of the cervix uteri.

"Branches from the spinal nerves enter this ganglion, fibers from the third sacral nerve and also the second and fourth (infrequently from the two latter together). Most of the fibers destined for the uterus pass through the cervical ganglion and have a direct connection with the ganglion cells.

"Another ganglion situated near the uterine insertion of the true ovarian ligament is composed of an anastomosis of the uterine and spermatic nerves.

¹ Monats. für Geburt. und Gynäkol. Bd. xxi, 1.

² BOSTON MEDICAL AND SURGICAL JOURNAL, vol. cliii, 449.

³ Das Verhalten der Nerven in der Substanz des Uterus, Arch. für Gynäkol., Bd. lxxx, heft 1, 135.