

I can only deal with the more important cardiac hypertrophies, and even those must be dealt with briefly.

The principal causes of cardiac hypertrophy other than disease of the valves, of the myocardium and of adherent pericardium can be divided for the sake of convenience as follows :

1. Organic changes in the arterial system, including obsolescence of the capillaries, and also congenital narrowing of the arteries.

2. The overfilling of the circulation.

3. The circulation in the blood of either foreign substances, or an excess of substances which in small quantities is a normal state.

4. Causes that act in a manner still unknown on the general or cardiac nervous system.

1. *Arterio Sclerosis*.—This is one of the most frequent causes of cardiac hypertrophy, and within the past few years has attracted great attention. It is, as is well known, a frequent condition after the fiftieth year, but it is not by any means a constant change in the physically degenerative period of life. It is not uncommon to often find the arteries of aged people free from any such change. Bamberger mentions that on several occasions he has found the arteries free from sclerotic changes as late as the ninetieth year. Then there is the famous case recorded by Harvey, where sound vessels were found in a man at the very advanced age of 153 years.

Although it is uncommon to meet with marked sclerosis under the thirtieth year, it still occurs sufficiently frequently to make it matter of great clinical interest and importance.

The most important form of arterio-sclerosis is that which occurs as a diffuse process, in men from the thirtieth to the fifty-fifth year.

Councilman, at the meeting of the Association of American Physicians in 1891, read a valuable paper on the connection between arterial disease and tissue changes. His observations were founded on the examination of forty-one cases which had been autopsied at the Johns Hopkins Hospital. He divided arterio-sclerotic changes into three different groups—the nodular, senile endarteritis and the diffuse arterio-sclerosis. All these varieties are followed at times by hypertrophy of the heart.

In the nodular form the changes are limited to the aorta and large arteries. The aorta is covered here and there, especially at its origin, with elevated patches, cartilaginous or calcified in appearance. Otherwise the lumen of the vessel presents a smooth aspect.

In this nodular form of arterio-sclerosis, hypertrophy of the heart is very common. In advanced cases it is to a great or less extent almost constant, the loss of elasticity in the vessels throwing more work on the heart. When the heart increases in size it in its turn tends to increase the arterial changes, so that

we have the one condition keeping up the other, a morbid circle being formed.

In the typical senile endarteritis, the aorta and its larger branches are converted into almost rigid calcareous tubes. The arteries are irregularly dilated and lengthened. Cardiac hypertrophy is not as constant a result of the senile endarteritis as it is of the other varieties. This is in a great measure due to obsolescence of so many of the smaller arterial branches as people grow older. It is brought about by the loss of the elasticity in the arteries, so that the blood flow in the capillaries from being continuous becomes intermittent, and in many areas finally ceases.

No doubt hypertrophy of the heart in a certain sense must of necessity occur when the vessels have to a great extent lost their elasticity ; but owing to the cutting off of capillary areas this hypertrophy is more relative than absolute.

“The changes in the arteries due to age proceed slowly, imperceptibly, and, so far as the individual himself is concerned, unconsciously. If the heart responds normally to the calls for extra exertion demanded of it, the individual gradually descends into the vale of years, quite unconscious whether he has a heart or not. If this knowledge is forced upon him, trouble is not far off.”—Balfour (*The Senile Heart*).

The diffuse form of arterio-sclerosis is in many respects the most important ; here the arterial changes are widespread, affecting the whole arterial system to a greater or less extent. More than half of Councilman's cases were examples of the diffuse varieties, the youngest being a negro aged twenty-three, the oldest was a man aged sixty. The great majority of cases ranged in age between forty and fifty-five. Hypertrophy was present in every case, in some it reached an extreme degree.

Myocardial changes were found to be frequent, their extent depending on the degree of involvement of the coronary arteries in the sclerotic process. Dilatation of the heart is nearly always a constant accompaniment of the diffuse sclerosis of the arteries. In fact, in all varieties of sclerotic arteries the heart is not only hypertrophied, but also dilated. Cohnheim has said that the great majority of all idiopathic cardiac hypertrophies are eccentric, and that non-eccentric hypertrophy has chiefly a theoretic interest. The dilatation in these cases may be so excessive as to give rise to the leaking of the valves.

Clinically there is a difference between the diffuse arterio-sclerosis and the senile endarteritis, the former being characterized by the high arterial pressure, a condition which is not present in the latter, at any rate, when pure and simple. If, however, the kidneys have undergone degenerative changes, the arterial pressure will be increased.