

fatal cases after operation for myoma of the uterus, due to embolism of the lung, and in all of which degeneration of the myocardium existed. Among others he quotes observations of Mahler,¹ who reported six instances with degeneration of the heart, thrombosis, and embolism.

Whether the operation or the etherization is the cause of the disturbance of heart action in these cases is, as I said in the beginning, an open question, impossible of solution at the present time. My own feeling regarding the matter is that etherization should be suspected of playing some part in weakening a previously diseased heart; and I would base this upon my experience in two other cases in which no pelvic thrombosis had taken place, in which there was no cerebral or pulmonary embolism, and in which the fatal termination was more or less unexplained, though the heart seemed from the clinical symptoms, as well as from the post-mortem examinations, to be the organ properly under suspicion. The first case was operated upon by Dr. Baldy for a repair of the cervix. I did not see the patient during life, and was not present at the autopsy, but saw the heart soon after the autopsy. The other organs were reported entirely normal, and at first sight the heart appeared equally so, but its substance seemed friable and resembled in its appearance the condition of the myocardium found in protracted fevers. Unfortunately, microscopical examinations were not made. The second case was one in which ventrosuspension was performed by a skilful operator, and the patient remained in good condition for two days, showing no unfavorable symptoms of any sort. On the third day after the operation the pulse suddenly increased in rapidity, the temperature rose, and in twelve hours the patient died. At the autopsy no abnormality was found in any of the organs excepting the heart, which presented a rather congested appearance, and which, on microscopical examination of a number of portions, examined somewhat after the manner of the serial sections of Romberg, showed intense congestion of the interfascicular capillaries and some acute myocarditis. There was no discoverable cause for this condition of things, and it seemed to me at the time, and has seemed to me ever since, that it was probably the result of etherization.

I am well aware that no positive conclusions are to be drawn from a discussion which has necessarily included many statements of opinion rather than of actually ascertained facts. I think, however, that the following statements may be tentatively made.

1. In all cases of cardiac disturbances after operations it is difficult to determine whether the result was due to the anæsthetic or to the operation.

¹ Thrombose, Lungenembolie und plötzlicher Tod bei Geburtshilfe und Gynäkologie. Arbeiten a. d. Kgl. Frauenklinik in Dresden. Leipzig, 1895, Bd. II, p. 72.

2. In many cases of recognized cardiac disease the administration of ether has a temporarily beneficial effect upon the cardiac condition. It is not improbable, however, that in some of these the secondary effect is an unfavorable one, the symptoms occurring after a lapse of some days.

3. It is important to recognize that certain results following operations, such as basal pneumonia, gastroduodenal disturbances, and especially embolism, are in reality the results of a weakened state of the heart, and that they may, therefore, owe their development to the anaesthetization or to the shock of the operation.

4. The untoward effects of anaesthetics are, I believe, due to the disturbance of the nervous mechanism or the essential muscular automaticity rather than to organic changes in the myocardium, endocardium, or pericardium.

PRE-EXISTING HEART DISEASE IN REFERENCE TO SURGICAL OPERATIONS.

BY WILLIAM J. MAYO, A.M., M.D.

SURGEON TO ST. MARY'S HOSPITAL, OF ROCHESTER, MINNESOTA.

THE demands of modern life tax the energies of the individual to the utmost. A sound heart in a sound body requires a new significance, for the stress falls to a large extent upon the circulation. Clinical observers of wide experience believe that diseases of the heart are on the increase, not the mechanical lesions which we so long considered the chief source of cardiac disability, but failure of the heart muscle through disease.

We have, heretofore, measured the heart power by the size of the obstacle to be overcome, but in reality more depends upon the perfection of the cardiac contraction and its ability to overcome resistance. The normal heart has a vast reserve power. The sound muscle fibre quickly recuperates from overwork, and the circulation but momentarily fails. This is not true of the compensating heart. Hypertrophy is a conservative process, but it does not begin at the exact moment the circulation is obstructed, but not at a time when at least a portion of the reserve has been expended. Compensation in itself presupposes a lessened reserve force. The more exactly the compensation balances the obstruction the less the liability of cardiac failure under temporary stress. To the surgeon the condition of the cardiac muscle is of prime importance. A crippled heart may compensate for the ordinary affairs of life, but the question is, has it sufficient reserve force to carry on its function during an operation, which, though temporary in character,

is attended by an increased call upon the heart's strength? The dangers to be feared are very real, and do not lie entirely in the anæsthetic. The necessary injury to the nerves and other tissues of the body with the loss of blood must be taken into account, and the amount of this operative traumatism cannot always be foretold with certainty.

The circulation demands that the arteries be kept overfull; the heart must be equal to keeping the pressure in the arteries greater than in the veins, and premonitory symptoms of a failing compensation must be earnestly sought before an operation is undertaken in the face of cardiac disease. The reserve power of the normal heart is not as great in infancy and old age, although the writer has not found this to be as true of the latter as the former period of life. Very fleshy people have less reserve force, and from an operative stand-point are generally looked upon with suspicion. People of unusual height are also supposed to have relatively less cardiac reserve. Our experience in the Northwest with people above the average height has been considerable, and we have found them, as a rule, most excellent subjects for operation.

The innervation of the heart plays an important part in estimating an operative risk. It must, at least, be sufficient to enable the reserve force to be called into play. His demonstrated that the power of contraction lies in the muscle fibre of the heart itself, and exists before the cardiac plexus is formed. The vagus and sympathetic are integral factors in the cardiac ganglia, and disturbance of function resulting in excessive rapidity or slowness of the cardiac pulsations may often be traced to reflex conditions acting through the nerve supply or be a personal or family idiosyncrasy. An irregular or intermittent pulse may also result from the abuse of tea, coffee, or tobacco. The cause in any event should be determined, and the probable influence upon the patient's ability to withstand an operation estimated.

Heart lesions may properly be divided into two general classes: First, valvular and endocardial disease; second, myocardial changes. The sharp distinction between them have, however, passed away with the advent of better knowledge of the subject. Myocardial changes are often found associated with valvular disease, particularly so when compensation begins to fail, while in the latter stages of myocarditis secondary valvular lesions are common.

Between the ages of ten and forty valvular disease is usually well compensated, and if the heart's action is easy and the circulation well carried out the operative risk is not great, and in our experience we have never lost a patient from this cause. There is but little liability of overlooking the condition, the early development of characteristic murmurs and the ease with which the hypertrophy can be recognized enables the surgeon to gauge the disability with a fair degree of accuracy. The operation is undertaken with full knowledge of the

cardiac disability and its character, and the choice of an anæsthetic is greatly influenced by this condition. If there is failing compensation and signs of marked dilatation only operations of the greatest urgency would be undertaken without preparatory treatment. It is fortunate that valvular lesions are the most common during the active period of life, at which time the large majority of operations becomes necessary. After forty, valvular lesions are usually associated with some degree of myocarditis.

I do not wish to be understood as minimizing the importance of primary valvular lesions, but rather to point out that the ease of diagnosis and the fair degree of accuracy with which the compensation can be estimated does not render it a frequent cause of operative mortality. The knowledge of the cardiac insufficiency robs it of much of its danger.

Myocarditis is the condition which the surgeon has reason to fear. There are often no sign-posts of danger, and the first intimation of trouble is the sudden death of the patient upon the operating table or shortly afterward. It may happen that the operation was performed for the relief of some condition which in itself was not serious, and which would not have been undertaken if knowledge of the heart disability had been previously obtained.

That a heart which is not increased in quantity as estimated by the usual means of diagnosis and the quality of its action seemingly unimpaired should suddenly fail when called upon for a temporary reserve force, is an appalling fact, but nevertheless true. Fortunately, the large majority of cases do give signs and symptoms which if looked for with care will enable the surgeon to detect the possibility of disease, and in the later stages the diagnosis may be self-evident. Cardiac symptoms after middle life not plainly pointing to valvular lesions are probably myocardial in origin. Preble quotes the following on myocardial disease from Huchard: "Their evolution is latent, their beginnings insidious, their course paroxysmal, their progress interrupted. They are complicated by a variety of visceral manifestations, and are brutally sudden in their explosions of cardiac insufficiency."

Acute myocarditis results from various infections and may date its origin to an attack of diphtheria, gonorrhœa, quinsy, influenza, or other infectious disease. If death occurs primarily there may be no macroscopical evidence of disease of the heart, the changes are microscopical (Stengel). Acute myocarditis usually passes into the chronic form, but the large majority of cases of chronic myocarditis are so from their inception. The disease is marked by the development of fibrous tissue, and other nutritive changes brought about through lesions of the coronary arteries. Rosenbach believes the fibrosis to be a conservative process and that it braces up a feeble muscular power. Freer, on the

contrary, maintains that it is primarily a destructive one, and analogous to fibrosis of the kidney.

Fatty degeneration of the heart, according to Strümpell, Van Leyden and others, seldom gives signs of its presence excepting in the later stages. In experimental fatty degeneration produced by Hasenfeld and Fennyvessy, there was no change in the cardiac size nor was the rhythm or force of the pulse affected. Stokes considered pseudo-apoplexy, soft blowing systolic murmurs with a slow pulse, pathognomonic of fatty degeneration, but as myocarditis was but little understood in his day it was only the cases in which this condition was more marked than the fibroid changes which were recognized. Fatty degeneration is often an accompaniment of myocarditis or one of its results, and the great loss of reserve force which it produces, together with the difficulty of even an approximate diagnosis, makes it the most serious disease of the heart from a surgical standpoint.

Lesions of the aortic opening and valves appearing about middle life can also be classed with myocarditis, and are often associated with it. Changes in the coronary vessels and at the base of the aorta usually coexist. This form of valvular disease has what may be called a physiological basis, and is more serious than similar lesions at the aortic opening in the young. Benike, by a series of measurements, has shown that after forty the aortic opening gradually increased in size, and it is easy to understand how severe work or disease might lead to grave consequences. Myocardial changes, associated with arteriosclerosis and contracted kidney, must also be taken into account.

The writer does not wish to discuss the symptomatology nor pathology of myocarditis, but merely to call attention to the diminished reserve force of the heart which it entails, and point out that many of the unexpected and sudden deaths which take place not or soon after an operation are due to this cause. A patient in middle or later life showing signs of progressive cardiac weakness manifested by a vigorous heart contraction with a feeble pulse, irregular in rhythm and associated with cardiac pain and attacks of dyspnoea with general loss of strength, is to be looked upon with suspicion, and an operation is not to be slightly undertaken. The more advanced cases of myocardial disease present such characteristic symptoms that only life-saving procedures would be indicated. Illustrating the operative mortality, the two following cases are briefly reported.

CASE I. Cholecystotomy in patient with chronic myocarditis; sudden death forty-eight hours after operation.—Mrs. J. D., aged thirty-five years, American. First abdominal observation in September, 1900, with a history of gallstone disease. On examination the heart's action was found to be 120, pulse feeble and intermittent, a faint mitral murmur could be detected. There was slight increase in size. Patient com-

plained of attacks of dyspnoea and oppression in the chest, and at times slight vertigo. No direct history as to the origin of the cardiac lesion. The attacks of colic were frequent and very distressing. Patient pale and anæmic. In the face of grave myocardial disease operation was not advised at this time. On January 5, 1901, she was readmitted to St. Mary's Hospital; the heart's action was very much improved, pulse 112, fairly good quality. Patient's physical condition better, but the attacks of gallstone colic were frequent and some jaundice had followed the last attack. On January 8th cholecystotomy was performed. The operation was easy and quick. There were no complications. Anæsthesia, nitrous oxide, and ether. Time, twenty minutes. Patient was in excellent condition for forty-eight hours, when she suddenly died from cardiac failure without premonitory symptoms.

CASE II. *Abdominal hysterectomy for malignant disease in patient with chronic myocarditis; death on operating table from chloroform anæsthesia.*—Mrs. E. E., aged forty-eight years, German. Admitted to St. Mary's Hospital on January 10, 1901. This patient came under observation four years ago with an ovarian tumor, and at that time had physical evidences of myocarditis. The tumor was removed under ether anæsthesia. She had remained in fair health except for occasional attacks of dyspnoea, palpitation, and a chronic cough. She returns now for the relief of malignant disease of the body of the uterus. On the day following admission the patient developed influenza and bronchial pneumonia, and over two weeks elapsed before she was in a condition for operation. The heart's action was forcible, the pulse full, intermittent, and 120 to the minute. There was marked hypertrophy and a mitral murmur, with evidence of chronic myocarditis. On January 26th abdominal hysterectomy was undertaken under chloroform anæsthesia. This anæsthetic was chosen on account of the bronchitis which had been much aggravated by recent illness. The patient took the anæsthetic badly, and was given but little. The operation had proceeded about ten minutes, when the heart's action and respiration suddenly stopped and the patient could not be resuscitated.

Heart lesions secondary to the disease for which the operation is undertaken may be either valvular or myocardial, usually the latter. The most common are due to obstructed circulation by the pressure of large tumors, especially uterine myofibromata. Hofmeier collected eighteen cases in which sudden death occurred from this cause. Williams, of Bristol, in eight fatal cases unoperated, states that two died from heart disease. Pease met with four severe cases in twenty-four.

There is at first compensatory hypertrophy, later secondary dilatation and degeneration of the heart muscle usually associated with valvular disease. Sibilleau, in seventeen cases of this character, notes that the lesions are usually mitral. The dangers to be apprehended are not only at the time of operation, but later from embolus. We have met with five of these cases, all of them associated with large myomata, and in which no history of cardiac disease preceded the development of the tumor. In two the lesions previous to operation were exceptionally severe, and it seemed questionable whether an operation was justifi-

fiable. The convalescence of our patients after hysterectomy was uninterrupted, and three of the cases I was able to examine as to the cardiac condition after the lapse of a year or more. The improvement was most marked, the size of the heart greatly diminished, and the valvular lesions could only be detected by the most careful examination.

Without going into the mooted question as to the nature of exophthalmic goitre, it may be stated that at least some cases result in myocarditis or fatty degeneration of the heart, and perhaps this has been one of the causes of sudden death which follow thyroidectomy. In seven thyroidectomies for Graves' disease we had one death from this cause. The history of the case is briefly as follows:

CASE III. *Thyroidectomy for exophthalmic goitre in patient with myocardial disease; operation performed with local anæsthetic; death in twenty-four hours from cardiac asthenia.*—Miss K. S., aged twenty-seven years, American, occupation, house-work. Admitted to St. Mary's Hospital in May, 1899, with a history of exophthalmic goitre which had appeared a year previously. The severity of the symptoms was gradually increasing. The immediate cause of admission was an ovarian cystoma the size of a fourth month pregnancy. During the period of observation the pulse was constantly above 130, no direct evidence of cardiac lesion. The tumor was removed under chloroform narcosis. Recovery uninterrupted, and she was discharged in three weeks. Readmitted August 29, 1900. The phenomena attending Graves' disease had markedly increased, pulse weak, and constantly above 140, and on exertion 160 or more. There was a faint murmur to be detected at the apex of the heart, evidently mitral in origin. The heart was somewhat enlarged and feeble in action. Attacks of dyspnoea were frequent, and the patient very anæmic and emaciated. On September 1st the right lobe and isthmus of the thyroid gland were removed under local narcosis with cocaine. The operation was not attended by any untoward accidents. The pulse became exceedingly rapid after the operation and a mild delirium supervened. Twenty-four hours later the patient died from cardiac asthenia.

It will be noted that in the three fatal cases reported one died suddenly forty-eight hours after an easy operation apparently well borne. The second died from the anæsthetic on the operating table and the third twenty-four hours after an operation under local anæsthesia. In going over the records of the cases operated upon in the hospital with which I am connected over 1 per cent. have had some form of heart lesion existing before the operation.

THE SAFEST ANÆSTHETIC TO USE IN ORGANIC DISEASES OF THE HEART AND VESSELS.

By H. A. HARE, M.D.,

PROFESSOR OF THERAPEUTICS IN THE JEFFERSON MEDICAL COLLEGE, PHILADELPHIA.

It is a remarkable fact that very few people even with grave cardiac and vascular disease die as a direct effect of the anæsthetic. If statistics were looked into it would be found that very few people die from the effect of the anæsthetic in the presence of cardiac disease. A larger number of people die at stool or on going up stairs when suffering from disease of the heart than from the effects of anæsthesia. It will be found that the anæsthetics when skilfully administered usually exercise what might be called a beneficent rather than an evil influence. I am strongly convinced that in the majority of instances when accidents occur during the administration of an anæsthetic the anæsthetic is not to blame for the fatal result, but rather the shock of the operation. My reason for this belief is that I have had some experience in administering anæsthetics to patients suffering from grave cardiac diseases. I have always approached such cases with the feeling that the danger was very great, and I have again and again seen the patient's condition improve under the anæsthetic, so that in fifteen or twenty minutes after the use of the anæsthetic was begun the condition of the patient has been better than before it was employed.

Another point of great interest is the question of the reserve power of the heart in valvular disease, in which there is compensatory hypertrophy. Usually this is not taken into consideration. In healthy cases there is so much energy used by the heart, and there is so much reserve power. In disease we have very little reserve. As a result, as soon as the shock occurs the diseased heart cannot with the small amount of reserve force meet the conditions which are present.

Another point to be considered before taking up the various forms of anæsthetics is the question of poisoning by these drugs. I venture to say that not one surgeon in a hundred has any conception of the quantity of anæsthetic which his patient receives. Careful histories of the operations may show that so many drachms of chloroform or so many ounces of ether were employed, but this gives no information at all to one who really wishes to know how much anæsthetic the patient has received. Some of the anæsthetic goes into the air, and some into the lungs. The possibility of the patient being poisoned because the dosage is unknown or is not estimated is a very important one. Lawrie, in the consideration of this subject, has deserved much credit. He has taken the point that it is not the dose which is poured out to