whether she be a primipara or a multipara, an attempt at restoration of compensation should be made, to be followed, whether successful or not, by Cesarean section and sterilization. In these cases the use of a general anesthetic is doubtful and is absolutely dangerous in patients whose hearts are decompensated when operation is undertaken, and either local or paravertebral anesthesia should be employed.

In patients who have had mild aortic lesions or mitral regurgitation, who have not had previous breaks in compensation, labor may be permitted, but in all cardiac cases the second stage of labor should be eliminated by a prompt forceps delivery as soon as the cervix is dilated. If there have been previous breaks in compensation the abdominal route offers the safest means of delivery for these patients also and sterilization is advisable.

I do not wish to be understood, when urging abdominal delivery for serious cardiac lesions, to mean that the great majority will not pass through one or more labors successfully, irrespective of the method of delivery and of the nature of the lesion, provided the heart muscle is sound at the time of labor; but I do believe that the abdominal delivery will throw less strain on the diseased heart, and, therefore, result in the prolongation of the patient's life by limitation of damage; and I believe that in these cases we should consider not only the immediate result but the remote result as well.

There remains a considerable class of patients who develop cardiac symptoms during pregnancy in whom no definite lesion can be demonstrated; patients in whom the power of cardiac response is evidently very limited, who suffer from shortness of breath, rapid pulse, etc., on the slightest exertion during pregnancy, and yet in whom there is no definite lesion to be made out. It is presumable that many of these patients have a flabby, if not a diseased heart muscle, and that they require similar treatment to the patients who have definite valvular lesions. If rest, absence of all relievable strain and the use of digitalis do not restore the heart to a comparatively normal condition, these patients should be treated exactly as if a definite heart lesion could be made out and the strain of labor should be avoided, the patients being delivered by abdominal section. In certain patients the unsatisfactory heart condition is probably due to

a low grade toxemia from which they may not suffer in future pregnancies, but in other cases the symptoms are due to inherent weakness of the heart muscle and successive pregnancies will serve only to increase the trouble; and pregnancy should be absolutely forbidden or the patient will eventually become a cardiac invalid.

HEART LESIONS IN ANAESTHESIA.

BY F. L. RICHARDSON, M.D., BOSTON.

THE general public and, to a lesser degree, the medical profession have a fear of the grave results of anaesthesia on patients with heart lesions. While it is true that patients with heart lesions die while under the effect of an anaesthetic, it is much more often due to the operative procedure than to the anaesthetic, provided the anaesthetic has been wisely selected and properly administered. I am afraid that the anaesthetic and the heart have been made the goat in certain unfortunate cases, whereas the operation or the manner in which the anaesthetic has been administered are the real factors in the case. Please do not understand me as believing that cases with heart lesions offer no greater risks than healthy individuals, for this is obviously not true, but usually they are not as serious risks as they are believed to be. Snow, in one of the most classical books on anaesthesia, says: "If a patient is able to undergo an operation, he will not be an impossible subject for an anaesthetic." After the lapse of almost 70 years there is no reason to change this statement.

Valvular heart lesions that are perfectly compensated and with a reasonable margin of safety offer very little danger from the anaesthesia. When, however, compensation is broken or the margin of safety is very narrow the danger of the anaesthesia increases markedly. In general if the heart lesion does not interfere with the ordinary affairs of life it will not interfere with the taking of an anaesthetic.

Lesions of the aortic valve are more serious than lesions of the mitral valve, and stenosis is more serious than simple regurgitation. Endocarditis and degeneration of the myocardium offer much more serious risks than chronic valvular disease, and I have a great fear of angina pectoris.

In my care of patients with serious disease of the heart of whatever nature it may be,

there is one fundamental principle about which all our treatment should center—maintain the bloodpressure at a point as near the level which is normal for that individual as possible. One should keep this in mind in the preoperative treatment, the operative procedure, the selection and administration of the anaesthetic, and in the post-operative care.

Wherever possible, patients with cardiac lesions should be put in bed, if they are not already in bed, and watched for a number of days without any change in their medication or food. The patient should be in about the position that he will have to occupy after the operation. This gives one an idea of how the patient should behave under conditions that would be ideal during convalescence—in other words, it gives us a “base line.” Blood-pressure should be taken at least once a day and I wish particularly to emphasize the importance of the diastolic pressure. In this period one has an opportunity of observing the effect of the post-operative position on the condition of the lungs.

The character of the diet before operation should be changed as little as possible from the normal. If the operation is to be at all protracted it is advisable to reduce the fats and increase the carbohydrates. I feel that the giving of 10 to 20 grains of sodium bicarbonate two hours before the operation is of some advantage. Cathartics should never be given unless the patient is in the habit of taking them.

When the time comes for the operation the patient should be carried to the anaesthetizing room and never be allowed to walk or to exert himself in the least. Quiet, but not absolute stillness, should be observed as soon as the anaesthetic is started. Many of these heart cases are high-strung and nervous, and fright is certainly a factor that should be reduced to a minimum, even though it is not possible to eliminate it.

Morphine and atropin should usually be given as preliminary medication and it is necessary that they be given sufficiently early to allow of their maximum action before the anaesthetic is started.

The patient should be placed on the operating table in a comfortable position. If the patient has been in the habit of sleeping with 3 or 4 pillows there is a reason for it. The patient has discovered the position in which he sleeps most comfortably and no preconceived

ideas of ours should interfere with his comfort. There is a more potent reason for this than the simple giving way to the patient's whim. If one wishes to have a smooth induction it is necessary to have the patient physically as well as mentally comfortable. If this usual sleeping position of the patient is not compatible with the operative procedure the position should be changed very gradually after the patient is fully anaesthetized, for any sudden change may cause a serious interference with breathing or heart action. It is particularly necessary to change the position gradually when Trendelenburg is required, and the surgeon should be willing to dispense with this position in case of serious interference with the cardiac or pulmonary function, even if very inconvenient for him.

With regard to the selection of the anaesthetic. If the operation can be performed *without pain* under local anaesthesia and the patient is not too apprehensive, this offers by far the least risk. It must be remembered that many operations that can be performed under local anaesthesia without pain are not without certain sensations, namely, the feeling of pressure and traction, which may be interpreted as pain by a nervous and apprehensive patient. The fear in these instances may be a greater element of danger than the taking of a general anaesthetic would be. Fear and pain will drive up the blood-pressure just as surely as ether or nitrous oxide, and the exhaustion following a long operation under local anaesthesia is a factor that must be given proper consideration.

Spinal anaesthesia should never be given to patients in whom the compensation is broken or in whom the margin of safety is narrow. It is a good rule not to use this form of anaesthesia in any patient who will not stand a temporary fall in blood-pressure of 50%. Patients with arteriosclerosis stand spinal anaesthesia quite well and they usually have the sluggish nervous system well suited to operations on a conscious patient. Here again one should consider the nature of the operation, for it is generally conceded that spinal anaesthesia is not safe for operations above the umbilicus.

Paravertebral anaesthesia would offer many advantages over local or spinal anaesthesia if it were not for the preliminary dose of scopolamine, a drug that is too much of a depres-

sant and too uncertain in its action to be used in cases with serious heart lesions.

Gas-oxygen, which has been heralded by its enthusiastic supporters as the safest of all general anaesthetics, is in reality far from safe in many cases, especially in cases of broken compensation or angina pectoris. I believe that this danger is probably due to the rise in blood-pressure that is always present to a certain degree and may become quite extreme if rebreathing is excessive or where cyanosis is present. Operations requiring little or no muscular relaxation and of short duration may in many cases be done with less disturbance to the patient under gas-oxygen than under any other form of anaesthesia, but where the operation is of long duration, and especially if muscular relaxation is required, this form of anaesthesia offers certain grave dangers. It must be remembered that great changes in the condition of the patient may occur with alarming rapidity and with little or no warning under this anaesthetic. This may be due to the rapidity of the action of nitrous oxide or to the nature of the surgical procedure. Whatever the cause of these changes, they are none the less alarming and dangerous.

One of the advantages claimed by the enthusiastic supporters of gas-oxygen is the rapidity with which the patients regain consciousness after the operation is completed. This is certainly dramatic; but is it a real advantage? If the operation is one that will be followed by much pain the patient regains full consciousness at a time when this pain is at its height, and this may in part counterbalance the advantages of this form of anaesthesia. The pain is much less if the technic of Crile is followed out, but there is the loss of some time in doing the local anaesthesia.

Another advantage claimed for gas-oxygen is the lack of nausea and vomiting,—matters of considerable importance,—especially in heart cases. In my hands I believe that almost as many patients vomit after prolonged gas-oxygen anaesthesia as after ether, but the duration and severity of the vomiting are much less. This is a real advantage.

Ether, like gas-oxygen, drives up the blood-pressure; but to a less extent, if properly given. Ether is a cardiac stimulant of more even action. Its use is usually followed by a period of deeper and longer depression than gas-oxygen, and it is this period of depression, fol-

lowing the administration of ether, that one should fear rather than the actual operative period. There are hardly any patients with heart lesions who will not go through the operative period with an ether anaesthesia, but some of these patients will not survive this period of depression following. To a certain extent the length and severity of this period of depression are governed by the depth of the anaesthesia and the length of the operation.

Chloroform, unlike gas-oxygen and ether, lowers the blood-pressure. Chloroform has certain advantages over ether. It is not unpleasant to take and it is somewhat quicker in its action. There are three periods of danger in its use. (1) Probably the highest percentage of fatalities in patients with heart lesions occurs during the induction, where with little or no warning the heart action stops. When this occurs it is not often possible to resuscitate. (2) The second period is during the maintenance, and the danger here is much less than in either the first or the third periods. (3) The third period is from 3 to 5 days after the operation and is due to the toxic action of the chloroform on certain organs, notably the liver, adrenals and heart muscle. Unfortunately, this action has not been recognized until quite recently; deaths occurring during this period being attributed to other factors than the anaesthetic. I do not feel that we are yet in a position to estimate the seriousness of this danger period, though I believe that it is of real importance.

Theoretically, it would seem as if we should be able to combine ether with chloroform in such a way that there would be little or no change in the blood-pressure. This has been tried for many years, notably by the English in the various A. C. E. mixtures. A mixture of ethyl chloride, chloroform and ether has been commercially exploited and largely used in America, but I believe it is now falling into disuse, as are the A.C.E. mixtures of the English. These various mixtures of chloroform and ether are much like the "standing orders" for the use of various drugs at some of the hospitals. They fit some cases admirably but are quite unsuited to other cases. The addition of a little chloroform to the mask is very useful where inducing anaesthesia with ether, but the mixture should be made on the mask as indicated and not accord-

ing to any preconceived formula. A very little chloroform dropped on the mask with the ether shortens the period of induction and reduces the amount of excitement. It also diminishes the rise in blood-pressure that is seen with a straight ether induction. Chloroform will also quiet the cough of a patient with bronchitis, but it is very rarely desirable to continue its use after the period of deep anaesthesia has been reached.

During the post-operative period it is more important in these heart cases than in the ordinary cases to prevent any unnecessary overload and to maintain the nourishment of the patient at a high level. Overload may come from various causes; among them kidneys and intestines play a large part and it is necessary to keep them functioning properly. Water should be given freely. When for any reason it cannot be given by mouth it must be given either by rectum or subpectorally, and in rare instances intravenously. It is advisable to begin food by mouth very early, and when I speak of food I do not mean beef tea and chicken broth; I mean food of real caloric value. When a patient cannot take food by mouth within 18 hours it is advisable to give nourishment by rectum. Glucose may be given by rectum in 5 to 10% strength and liquid peptanoid may be added to this if desired or wherever rectal feeding has to be given over a protracted period.

The urine should be carefully watched for acetone, and to those cases showing a considerable rise, sodium bicarbonate should be given in small and repeated doses. Of the so-called heart stimulants, most are absolutely useless. The judicious use of morphine must not be forgotten. More heart cases require rest after the operative period than require stimulation.

In conclusion, I wish to emphasize the importance of attention to the careful and detailed treatment of heart cases during the pre-operative and post-operative periods as well as during the operation and anaesthesia.

DISCUSSION.

SIR JAMES MACKENZIE, London: I have been long deeply interested in the two questions under discussion—of the heart in pregnancy, and in anesthesia. As a matter of fact, one of the chief reasons for my interest in cardiac affairs

arose from the study of the heart in pregnancy. About a year or eighteen months after I entered practice a woman, with mitral stenosis, whom I attended, died in labor after thirty-six hours of great suffering, from heart failure. There arose in my mind the question whether I could not have saved her had I a better knowledge of the subject. For that reason I studied the literature to see where I had failed in my duty toward her. I found that the subject was fairly well summed up in a book written by Dr. Angus MacDonald of Edinburgh in 1876. Lately I have read some recent literature on the subject, and I find that obstetricians had evidently made no advance on MacDonald's book. The subject is of importance to every general practitioner, for the question is not seldom put to him whether a woman with a heart affection should run the risk of pregnancy, and so much depends upon his answer. Yet it is a subject which has received little consideration. The reason for this is that the physician never sees a childbirth, and the gynecologist rarely sees a case of heart failure.

I had ample opportunity in my practice for investigating the effects of pregnancy on the maternal heart. The method I followed was to examine women before pregnancy, and watch them during pregnancy and during labor, and through the puerperium, and after recovery and in some cases during repeated pregnancies, making notes of all circulatory changes. After a number of years I had a lot of facts collected about the heart in pregnancy. I found variations in the size and shape of the heart, modifications of the sound, and variations in the rhythm, and sometimes the veins of the neck became distended with marked pulsation. I wanted to know what all these signs signified. I turned to the text books and I could not find from them what bearing they had on the matter.

To get a clear conception of the nature of the danger I put the question, "What are you afraid of when a woman with a heart affection becomes pregnant?", and I found that it was a fear that the heart might fail. Then the question arose, "What is heart failure, and what are the phenomena that heart failure produces?" As a rule, the evidences of heart failure that are described in books are such signs as dropsy and enlargement of the liver. But what are the phenomena before such an ad-