same picture as noted in the cerebrum. The choroid plexus was chiefly interesting because of the presence of numerous psammoma bodies.

CONCLUSIONS

1. Edema of the brain occurs in the infectious diseases.
2. Its presence not infrequently masks the symptoms of the disease in which it is due, and it may be considered as a type per se.
3. The primary involvement may be that of the central nervous system.
4. There is an interrelationship between the cerebro-spinal pressure and that of the cutaneous circulation. This relationship is one of direct variation.
5. The outbreak of a marked cutaneous eruption in a case presenting symptoms of intracranial pressure is a favorable prognostic omen. These patients recover.
6. Lumbar puncture is indicated in these cases.
7. White light electric baths, in that they favor an increased cutaneous circulation, are beneficial and are preferable to hot tubs of from 105 to 110 F., though the latter are productive of good results.

25 West Forty-Fifth Street.

CARDIOVASCULAR EXAMINATIONS OF FIFTY-FIVE THOUSAND RECRUITS

GEORGE EDMESTON FAHR, M.D.

Contract Surgeon, U. S. Army

ASSISTED BY LIEUTS. D. W. CARTER, M.D. (GEORGETOWN, TEXAS); J. H. COSGROVE, M.D. (DULUTH, MINN.)
AND J. D. EDGAR, M.D. (HENRY, S. D.)

CAMP TRAVIS, FORT SAM HOUSTON, TEXAS

There is no reason why diseases of the heart should not be given equal rank with tuberculosis, for in civil life they result in at least as many, if not more, deaths. In the Allied armies more disability is due to cardiovascular disease than to tuberculosis. The recent report to Parliament showed that of the 350,000 men in the British army discharged and pensioned for wounds and diseases, a little over 10 per cent. were for heart disease and about 11 per cent. for chest complaints and tuberculosis. When we consider that whenever tuberculosis is found in the soldier he is discharged and pensioned, whereas very many of the men with cardiovascular disease are not discharged but are merely put in deferred classes of the Army, we see that circulatory diseases are undoubtedly of more importance to the Army than tuberculosis. It will surprise many to know that there are two and one-half times as many pensions for heart disease in the British army as there are for the loss of limbs, and nearly twice as many as for nervous diseases, shell shock and epilepsy together.

The cardiovascular board examining recruits at Camp Travis, Texas, has completed the examination of 55,000 men and finds itself in possession of information interesting from the standpoint of statistics as well as instructive to the local boards in their efforts to limit the number of men sent to the training camps who are unable to undergo severe bodily exertion because of circulatory diseases.

The system of examining recruits at Camp Travis at present is briefly as follows: After arriving at the camp, the recruits are marched in a body to the receiving station, where they receive their papers from the

personnel board, are stripped, given a shower bath, and then sent to the various special boards examining in the same group of buildings. The last board to examine them is the cardiovascular board. This board has its quarters in the quietest wing of the building. The two members of the cardiovascular board working in this building simply attempt to pick up cases for more thorough examination. It is thus possible for two examiners to complete the examination of 1,500 men for cardiovascular disease in one day. An attempt is made to differentiate murmurs due to valvular lesions from purely accidental ones and to select as far as possible only such cases of tachycardia for more thorough examination as show the other symptoms of irritable heart or hyperthyroidism. A much more extensive examination is then given the selected cases by the third member of the board, who has his quarters in an adjacent building with the discharge board of the camp. After this examination, the recruit is classified and accepted or discharged.

The two members performing the first examination usually consult over each case before sending it to the discharge board, and the member of the cardiovascular board working with the discharge board consults and discusses the difficult and ambiguous cases with the other two members constantly so that no man is discharged from this camp without a thorough examination and critical discussion, unless the case is a very simple one. The cardiovascular board has also learned much from examination of a large number of enlisted men of the Ninetieth Division now stationed abroad. The board also receives a certain number of men from the training battalions into which the men had been inducted after the first cardiovascular examination, for reexamination and reclassification, who have been found unable to stand up at drill, showing signs of dyspnea, precordial pains or fainting on exertion.

We believe that our figures show approximately the amount of valvular heart disease incident to young men in the ages from 21 to 31 living in the states of Texas and Oklahoma. We can hardly believe that the majority of the local boards sending men to Camp Travis are capable of picking up many cases of valvular diseases of the heart. In the earlier draft increments, we found twelve men in 10,000 troops with aortic insufficiency, presenting symptoms of a large heart pulsating strongly in the axillary line with loud diastolic murmurs at the sternum and often at the apex, with typical Corrigan pulse and all the features of outspoken aortic disease, marked by local boards "heart normal." The last two increments yielded a smaller percentage. The last increment of 19,000 men yielded only eighteen cases. We have found the same to be true of mitral diseases. Local boards which could not discover the majority of the cases of aortic and mitral insufficiency discharged by us would certainly reject extraordinarily few of the cases of organic heart disease passing through their hands. Undoubtedly, however, the excellence of the work done by the local boards varies from board to board, so that our statistics do not give the actual percentage of young men suffering from these diseases; but they certainly give the order of magnitude of the incidence of valvular disease at these ages in these states.

AORTIC INSUFFICIENCY

We found fifty cases of aortic insufficiency in examining 55,000 recruits, that is, 0.09 per cent. With

only a few exceptions, these were outspoken cases with loud diastolic murmur heard all over the sternum and often at the apex, with hypertrophy to the left, with Corrigan pulse, with high pulse pressure and all the other classic signs. In a few cases the murmur was very soft and faint and the hypertrophy slight. One of these men was a university athlete, a high and broad jumper. He was at the time of the examination able to undergo severe bodily exertion, but he had all the signs of aortic insufficiency and a history of polyarthritis in childhood. One of the most interesting cases was that of a Texas cowboy, a man who had been a "broncho buster." This man had once noticed while riding a wild horse that something seemed to break behind his chest bone and that there was pain present behind the sternum for some time. There was a high pitched musical diastolic murmur heard over the second intercostal space to the right and left and over the sternum. The pulse pressure was only a little larger than normal, there was no hypertrophy, and there were no signs of dyspnea on hopping. The man professed to be able to do hard work, but had found it necessary to give up broncho busting. It would appear that we might have here one of those rare cases of a rip in one of the semilunar leaflets brought about by a strain and trauma. Of course it is impossible to verify this without the records of examinations previous to the occasion when the accident supposedly took place. It is interesting to note that only once did a local board mark a case of aortic insufficiency anything but normal. In this one case in which the aortic diastolic sound was especially loud, was heard at the apex as well and was accompanied by an apex beat in the axillary line and by relative mitral insufficiency, the local board marked its findings "apex sound prolonged."

Most of the cases of aortic insufficiency were undoubtedly due to polyarthritis. In many of the cases there was also a history of syphilis; but the syphilis had been acquired only a few years before. In these young men with a history of polyarthritis, tonsillitis and syphilis it seems most probable that the lesion is rheumatic in etiology. The incidence of aortic disease in the colored race was slightly greater than in the white. Most of these afflicted with this lesion were doing hard labor. Some of them certainly appeared capable of the severe bodily exertion demanded of soldiers. In fact, they were often physically better than those whom we discharged for irritable hearts and in whom there was no valvular lesion. As long as the leakage is only slight and the heart muscle is capable of doing the extra amount of work necessitated by the leakage, these hearts respond very well to a call for severe exertion. It is later, when the increasing leakage puts an increasing handicap on the heart muscle and when the heart muscle begins to weaken, that these men notice symptoms. Pain over the sternum is often for a long time the only complaint. In this connection, we recall some cases of aortic regurgitation seen at Nauheim during the early period of the war. The men had served their period of enlistment years before, had developed an aortic regurgitation in the interim and were mobilized after a very superficial examination at the beginning of the war. These men were farmers and laborers and went through many days of hard marching with 75 pounds on their backs. At a time when men with healthy hearts began to be exhausted from the forced marches through Belgium and Russia, these men began

to show signs of heart failure; pain, dyspnea, swollen ankles and hemoptysis. When once this exhaustion of their cardiac muscle had taken place, it seemed to be accompanied by a permanent impairment of the cardiac reserve, so that these men who had been mobilized as efficient laborers had to be discharged after treatment at the spa as partial invalids capable of only light work. For this reason, we are convinced that it is best to exclude all men with aortic lesions, even when the leakage appears slight and the heart muscle capable of taking care of it.

MITRAL INSUFFICIENCY

There were thirty-nine cases of mitral insufficiency unaccompanied by another lesion, that is, 0.07 per cent. It will probably astonish many who believe that mitral insufficiency is relatively a very common valvular lesion. On the other hand, we believe that those who have had considerable experience with heart disease, both clinically and pathologically, will agree that mitral insufficiency of endocarditic origin and uncomplicated by mitral stenosis is relatively not very much commoner than aortic insufficiency. Relative mitral insufficiency accompanying myocarditis in the middle aged and old, or associated with other valvular lesions, is relatively, of course, very common. There has been a tendency to consider a loud systolic murmur at the apex pathognomonic of mitral insufficiency. Many of these murmurs are undoubtedly not due to valvular lesions at the mitral orifice. It is true that the members of the local boards will undoubtedly pick up and discharge more cases of mitral insufficiency than aortic insufficiency because the mitral systolic murmur is much more easily recognized than the softer aortic diastolic murmur. On the other hand, we cannot believe that the local boards have picked up and discharged very many cases of simple endocarditic mitral insufficiency, for these boards have sent to camp a large number of men with loud systolic murmurs which on careful examinations have turned out to be accidental murmurs, but which had not been noted by the local board.

ACCIDENTAL MURMURS

Our experience in reviewing the findings of physical examinations at one of the largest universities in the country and as members of medical advisory boards, as well as here at Camp Travis, have shown us that the average practitioner has not had the great incidence of accidental heart murmurs in the young impressed on him sufficiently. We have never forgotten the case of one of our college classmates who was advised against taking part in athletics because he had a "leakage of the heart." This man became famous as a cross-country runner and as 2-mile champion both here and abroad to the astonishment of the examining physician, who had heard a systolic murmur. We have seen numbers of young men turned down by the examiners for the Aviation Corps and the Navy for nothing more than systolic accidental murmurs, some of them heard in the second interspace. Some of the men appearing before us for examination present statements from one or more physicians vouching for their inability to become soldiers because of valvular lesions. All these men show nothing but simple accidental murmurs. Every cardiac consultant can recall many young lives at least temporarily blighted by one of these diagnoses. One of the men examined by us had been turned down by the local board with the statement,

"Physically deficient by reason of cardiac murmur." The advisory board had diagnosed it "mitral regurgitation," but for some reason had passed the man. The murmur was an accidental one heard best in the third left interspace. The etiology of mitral regurgitation in this case will certainly be of interest to the readers of this article. The young man had been in love with a girl. He had bought himself a homestead, had worked hard on this, doing his own house work as well as field work and hoped finally to lead the blushing bride back to the farm which he was preparing for her. When all was ready, the girl turned him down. According to his statement, this caused him heart trouble. On close questioning his trouble seemed to be more in his stomach than in his heart, and we felt that despite this very real "heart" trouble he might still make a good soldier.

We found that 3.2 per cent. of all our recruits have an accidental murmur; and by accidental murmurs we do not mean reduplicated and impure first sounds but real murmurs with a swish or rumble, often very rough and loud, and in quality indistinguishable from the murmurs associated with real organic lesions. As Lewis has insisted, in the examination of English soldiers, "neither the quality, intensity nor transmission of a murmur is sufficient for distinguishing it." There is a soft systolic murmur usually disappearing on recumbency which most physicians distinguish as an accidental murmur, but many of the loud, rough systolic murmurs transmitted into the axilla lead to the diagnosis, "mitral insufficiency." In one of the latest American works on the physical diagnosis of the chest we find the false statement that "accidental murmurs are never loud and rough." It must be insisted on that whenever there is an organic insufficiency at the mitral valve of any importance, the left ventricle must dilate in order that the heart may do the extra amount of work set for it and pump out the increased minute volume. The regurgitation of blood backward must lead to increased pressure in the pulmonic circulation with accentuation of the pulmonic second sound and dilatation of the left auricle. Without hypertrophy and signs of embarrassment of the pulmonic circulation, there should be no diagnosis of mitral insufficiency excepting, of course, when the physician has heard a systolic murmur developed during or following rheumatic fever or other infections. Even then the diagnosis must be made with reserve unless the other signs are present. We recall here the case of a recruit recently examined by us. He had been rejected for the Texas cavalry because of an extremely loud and rough systolic murmur. This boy had two typical attacks of polyarthritis in childhood. When we examined him, the pulse rate was 108; but the young man told us he had many times examined it himself and had always found it to be 70. The apex beat was well within the midclavicular line. Percussion of the left border showed it also inside the midclavicular line. The pulmonic second was louder than the aortic but not accentuated; the response to effort was good; he played baseball and was a good swimmer. We were all agreed that despite the history of polyarthritis in this case, there was practically no regurgitation through the mitral valve. We do not care to discuss here what may be the causes of these murmurs; but we do wish to point out that the loudest systolic murmur unaccompanied by definite signs of pathologic anatomy and of pathologic

physiology in the circulation should not lead to a diagnosis of valvular lesions. The left auricle in contradistinction to the left ventricle cannot be burdened with even moderate amounts of regurgitated blood without embarrassment to the pulmonary circulation.

Good judgment must also be exercised in making use of a pulmonic second sound louder than the aortic. The pulmonic second is usually louder than the aortic in men at these ages, especially when recumbent. If the pulmonic is not merely louder but is accentuated or reduplicated, this evidence is in favor of the diagnosis of mitral disease. But we have found cases with reduplicated and accentuated second pulmonic sounds in hearts without murmurs or hypertrophy and with no symptoms.

The determination of hypertrophy of the left ventricle is fraught with uncertainty in many cases if percussion and position of the apex beat are the only means for determining the left border of the heart. It should be emphasized that the apex beat is not always a reliable index of the position of the left border. Usually the apex beat is inside the left border of the heart as determined by the orthodiagram or accurate percussion; but sometimes the apex beat is one or more centimeters outside the left border as determined by the orthodiagram, especially when the heart is overactive. Hypertrophy of the left ventricle was once diagnosed in the author by a very good clinician because the apex beat was strongly felt in the anterior axillary line. An orthodiagram of the heart showed the left border to be well within the normal limits. This led to the investigation of a number of thousands of cases by Professor Weber at Nauheim. It was found that many patients with supposed dilatation determined by the position of the apex beat and sent to this spa for treatment showed normal orthodiagraphically determined borders, the real apex being seen on the fluoroscopic screen of the orthodiagram to be pulsating well inside the nipple line. In the course of our examinations of 55,000 men we have found the apex beat in many cases outside the nipple line in hearts whose border as determined by roentgenoscopy or percussion was inside the nipple line. This was found to be especially the case in those chests in which the thorax suddenly curved posteriorly before the nipple line was reached. In these chests the thrust of the apex is propagated out beyond the actual position of the apex in the frontal plane. We believe that careful percussion conducted in a very quiet room by physicians who have practiced and carefully controlled their percussion orthodiagraphically in hundreds of cases is often superior to the palpation of the apex beat in determining whether a hypertrophy is present or not. Of course, whenever possible, roentgenographic methods, making use of parallel rays, are the methods of choice.

The response of the heart to effort may aid in determining whether the possessor of a systolic murmur has an organic heart lesion or not. But this may also leave us in doubt, for many cases of irritable heart that have a poor response to effort also show a systolic murmur. Critical judgment and an extensive experience in the physical signs of normal and pathologic hearts is indispensable in finally deciding where to place certain cases; but usually we have not found it difficult to determine when a systolic murmur is the sign of a real organic lesion at the mitral valve. We desire again to emphasize the great value which per-

cussion of the heart borders, combined with a comparison of the orthodiagram of the heart, has been to us personally in determining the accuracy of our percussion. We have had success in the teaching of percussion to students by this method. If this method were followed in all our medical schools, we feel that there would be fewer diagnoses of left ventricular hypertrophy, on hearing murmurs that are undoubtedly accidental.

The greater part of the accidental murmurs (2.5 per cent.) were systolic and loudest over the apex. About 0.6 per cent. of all the recruits showed systolic murmurs loudest over the second left intercostal space. Only about 0.2 per cent. showed pronounced cardiorespiratory murmurs. About 0.2 per cent. showed murmurs loudest over the second right interspace and transmitted into the carotids. There were none of the other symptoms of aortic stenosis, and neither roentgenoscopy nor percussion showed any enlargement of the arch. There were no symptoms, and therefore both aortic stenosis and aortitis being reasonably surely excluded, the diagnosis of accidental murmur was made. There were four recruits (less than 0.01 per cent.) found with diastolic murmurs after due deliberation classed accidental. These murmurs are very soft and usually heard only in the earlier parts of diastole. They are usually influenced by respiration, nearly disappearing on inspiration. There is no history, and there are no symptoms nor any signs of aortic insufficiency associated with these murmurs. In one case there was a peculiar diastolic murmur heard over the second right interspace over the whole of the lower sternum and to the right of it when the recruit was standing. This murmur was increased on expiration but did not disappear on inspiration. In the recumbent position, there was no diastolic murmur heard, its place having been taken by a soft systolic respiratory murmur. The blood pressure was 130 and 80; tonsillitis was the only disease in the patient's history. There was no hypertrophy, and the recruit had never experienced dyspnea or pain over the chest; in fact, he remarked that he always feels well. Here again, we see that no one symptom alone is pathognomonic. Time and again we have had cases in which there was no pathologic condition referred to us with a diagnosis made from one symptom alone.

STENOSIS, HYPERTROPHY AND OTHER CONDITIONS

Mitral stenosis is apparently very rare in the states of Texas and Oklahoma. We have found only ten cases of undoubted mitral stenosis (presystolic murmur, accentuated second pulmonic, typical mitral outline) in an examination of 55,000 men. Rheumatic fever is probably very uncommon in these states. We have been very careful not to diagnose a mitral stenosis unless there was a definite typical presystolic murmur with accentuation of the second pulmonic sound.

We are altogether opposed to making a diagnosis of mitral stenosis from a loud, slapping first sound. If there is no presystolic murmur or thrill, there is no stenosis in these early stages. We have never been able to confirm Mackenzie's statement that the presystolic thrill is to be felt before the murmur is developed. At least by the man of slight cardiovascular experience, the presystolic thrill alone should never be used to diagnose a case. There are certain impurities of the first sound suggestive of presystolic murmurs that have led

to the diagnosis of mitral stenosis. Some years ago we showed by graphic records that there are a few sound vibrations in the first 0.1 second preceding the normal first sound.¹ In some individuals, these vibrations have considerable amplitude. In one man investigated by us graphically, these vibrations varied in amplitude, on some days being loud enough to cause an impurity of the first sound. But these impurities are never as loud nor as prolonged nor of crescendo character, and so far as our experience goes never accompanied by the loud, slapping first sound of mitral stenosis. Exercise usually causes them to disappear, whereas the true presystolic murmur of mitral stenosis is increased in duration and intensity after exercise. The impurities should not cause the cardiovascular examiner any trouble if he is careful to consider all factors. The presystolic sound of mitral stenosis is not easy to recognize, and it is very probable that only such cases as were badly decompensated were recognized by the local boards. We believe that our figure for the incidence of mitral stenosis gives a tolerably fair idea of the order of frequency of this disease in Texas and Oklahoma.

We have found aortic stenosis complicating very few of our cases of aortic insufficiency. We have found no case of uncomplicated aortic stenosis. There have been many cases with a systolic murmur on the second right interspace and transmitted into the carotids, but unaccompanied by thrill over the interspace, by the typical pulsus durus and the faint second aortic sound. These cases have always been classified as accidental murmurs.

There were six cases of idiopathic hypertrophy with no apparent cause. There was no hypertension at the time of the examination, and it was not possible to observe these cases over a long period. Very possibly the hypertrophy was associated with periodic crises of hypertension. Ten recruits had hypertension, that is, a systolic pressure continuously above 160 mm. There were symptoms of nephritis in only one. One case suggested Pat's vasomotor crises. This man gave a history of attacks with severe pain over the chest, throbbing in the head, flushing of the face and headaches. His blood pressure was very labile during the period that we had him under observation, the systolic pressure ranging from 170 to 220.

Among the rare heart diseases we found one case of heart block with a rate of 38 and Stokes-Adams syndrome. There was no increase in the rate on exercise or after atropin. There was a history of syphilitic infection two years before. The fainting spells began five years before so that syphilis probably has no connection with this case of heart block. We also found one case of patent ductus arteriosus with a typical to and fro murmur in the second and third left interspaces transmitted to the interscapular region on the left side, with a loud second pulmonic sound, and pulsation in the third left interspaces. There was no hypertrophy, and the man felt perfectly capable of every exertion. He was accepted for service. There was one case of congenital septum defect, marked cyanosis since birth, clubbed fingers, moderate dyspnea on slight exertion, a loud systolic murmur heard best over the lower end of the sternum and to the left of sternum in the fourth interspace. This murmur was transmitted to all parts of the anterior chest wall and

1. Fahr, G. E.: On Simultaneous Records of Heart Sounds and Electrocardiogram, *Heart* 4: 147, 1912.

also into the back. The second pulmonic sound was loud. There was no enlargement to the right. We believe that the best guess in this case is patent foramen ovale. There was one case of dextrocardia with situs inversus. There were only seven cases of hyperthyroidism.

Excepting for the respiratory arrhythmia, common at this age, irregularities in rhythm are fairly rare. We have found that about 0.05 per cent. of all have extrasystoles of ventricular origin with no other pathologic condition. Sometimes they were associated with bigeminal pulse, and sometimes with no pulse following the second systole of a coupled beat heard at the apex. Usually these men were conscious of a compensatory pause, stating that their heart missed beats. It is customary for these extrasystoles to disappear entirely in a day or two after the excitement of mustering is all over. In the examination of 55,000 men, we have found but one case of pulsus irregularis perpetuus, a case of mitral stenosis and insufficiency with a soft diastolic murmur at the apex.

NEUROCIRCULATORY ASTHENIA

The condition previously known as irritable heart, but recently better designated as neurocirculatory asthenia, is by far the most important circulatory disturbance, both to the medical officer culling out at the recruiting station and to the medical officer examining at the front. For example, the report of one of the British base hospitals in France shows that out of 5,000 soldiers examined for circulatory failure only 5.5 per cent. had organic lesions and about 86 per cent. showed the condition known as irritable heart. In fact, the diagnosis of irritable heart is so much more important to the military surgeon than the diagnosis of organic lesions that Lewis makes the somewhat radical statement that the military heart specialist has no use for a stethoscope. Our experience at this camp seems to show that about 0.4 to 0.5 per cent. of all the recruits should be discharged for inability to stand up under severe bodily exertion because of neurocirculatory asthenia.

A brief description of the symptomatology of neurocirculatory asthenia² is perhaps not out of place at this point, especially as the condition has heretofore been described as seen at the front and not as observed in the training camp. Neurocirculatory asthenia, or the irritable heart of the soldier, as it is often designated, is not a condition determined by the exertions and emotional upsets of military life alone. This condition always exists among civilians. Careful inquiries have shown that among a large number of those who break down at the front with this disease, the symptoms were already present in civil life. The severe bodily exertion and the emotional stimuli associated with modern wars serve to bring out and emphasize this condition. Moreover, it is peculiarly inherent in the modern methods of conducting warfare. When military service is confined to a class who practice it voluntarily, irritable hearts will be few, because the possessor of the constitution of the neurocirculatory asthenic usually does not seek the strenuous life of the soldier. He is the type of man who avoids strenuous physical exertion and strong stimuli. Modern armies are obtained by drafting all men within certain age

limits; and these more timid, less strenuously inclined individuals are taken along with the rest.

The effort syndrome is the peculiar characteristic of neurocirculatory asthenia, namely, an exaggerated response to physical exertion and emotional stimuli. Slight physical exertion produces marked dyspnea, greatly increased pulse rate, a feeling of fatigue, and very frequently pain over the precordium. Even the slight emotional stimulus of the physical examination will cause sweat to trickle down from the arm pits or stand out in beads over the foreheads, or will cause a flush to appear in the face, and the pulse rate always goes up to from 120 to 150. Many of this class have cold, clammy hands, and show a coarse tremor of the fingers or of the lower limbs during the examination. In other words, very slight causes produce great effects in these individuals. They are the men who in civil life drifted from one occupation into another. Many of them are clerks, others are sign painters, barber-shop porters, any occupation that involves little exertion. Here in Texas, many of them, born as farmers, remain in this profession; but they give a history of avoiding severe bodily exertion. They almost invariably give a history of being unable to stand heat. They are subject to giddiness when forced to work in the hot sun, and are compelled to go into the shade to rest and cool off, when other men stick to their work. In other words, they are not first class men but belong to the constitutionally inferior class.

If these men are accepted by the recruiting authorities, it is noted that throughout the course of training they are continually falling out at drill, and they complain of weakness, pain over the heart, palpitation, inability to stand the hot sun, and inability to sleep after a hard day's work. They are often looked on as malingerers, and undoubtedly often they are when judged by our present standards. The company commanders like to get rid of them, transfer them, if it is impossible to get them discharged. If finally taken to the front, they are usually sent back to the base hospitals because the severe bodily exertions and emotional disturbances there are too much for them. Desire for alcohol and development of the sexual instinct have always been looked on as indicative of strength in men. As a class the neurocirculatory asthenics are not attracted by either Bacchus or Venus.

Neurocirculatory asthenia is probably not primarily a disease of the heart, but symptoms are due to an over-excitability of the autonomic nervous system, an irritable weakness of the vegetative nervous system. The rate of pulse at rest is always increased over that of normal individuals, owing to an increase in the tone of the accelerator nerves. Vagus tone seems to be normal. The increased activity of the sweat glands and the heightened response to the action of pilocarpin show that the parasympathetic system innervating the sweat glands has increased tone. The response to epinephrin is increased over that in the normal, showing increased excitability of the vasomotors. Many have marked sinus arrhythmia, showing that the centripetal vagus fibers from the alveoli of the lung are hyperexcitable. Many of these men show decided neurotic or psychoneurotic symptoms. We believe that all of the nervous symptoms can be explained on the basis of changes in the tone of the nervous systems, especially the vegetative.

In the foregoing we have been describing the most common type of neurocirculatory asthenic. At the

2. Lewis, Thomas: Report upon Soldiers Returned as Cases of "Disordered Action of Heart," Medical Research Committee, 1917; Report on Neurocirculatory Asthenia and Its Management, Mil. Surgeon 42: 409, 1918.

training camps one encounters another class, less frequently. In the latter class there are no signs of constitutional inferiority. These men give a history of having done hard work, of having played games, etc., until a severe infection, usually typhoid, pneumonia or influenza, was followed by a slow and incomplete recovery. From this convalescence they invariably date their inability to undergo severe exertion. The men in this class usually appear fit to the eye, but the exercise test is followed by dyspnea and distress and a marked increase in pulse rate, which does not go down for five minutes or more. These cases show the cold, cyanotic hands, the sweating and the coarse tremors less frequently than the cases that are associated with constitutional inferiority and psychoneurotic symptoms. Tachycardia is also present in these cases when they appear for examination. They correspond to the cases of Group 2 of Oppenheimer and Rothschild.³

The tachycardia is the symptom that draws the attention of the cardiovascular examiner to these men. The excitement of the examination and of the new environment tends to increase the pulse rate in all men; but, as stated before, the increase is greater in this class than in normal men. Of course, men having hyperthyroidism, men with high temperatures or recently recovering from infectious diseases, and men under emotional stress will also show increased pulse rate. After noting the increased rate, it becomes the duty of the examiner to classify the case. The hyperthyroid cases will show enlarged thyroid, eye symptoms and the characteristic fine tremor. They will usually give a history of loss of weight with good appetite, of much sweating and a "flying off the handle." Men recovering from infectious diseases will give the history. Many of those suffering from neurocirculatory asthenia will also give a history of infectious disease; in fact, as stated above, it would seem from our observation that typhoid fever, tonsillitis, pneumonia and influenza are often directly associated with the causation of this condition. We lay great stress on a history of inability to do hard work, wandering from job to job, precordial pain, lack of desire to play games, to swim, to skate, to take part in young men's activities, dyspnea on slight exertion and palpitation. A history of infectious disease followed by the symptoms of irritable heart is equally important; in fact, there should be no diagnosis of neurocirculatory asthenia without a typical history.

The objective examination is conducted as follows: The pulse rate is taken with the soldier standing and recumbent. The recruit is then made to hop 100 times on one foot. The pulse rate immediately after exercise and two minutes later are taken in recumbency. The typical case of irritable heart will show a marked difference between the rate recumbent and the rate standing. The heart reacts strongly to what is normally a very slight circulatory change. Hopping a hundred times is very mild exercise for the normal man, and the heart rate increases only moderately. There is only a very slight increase in breathing, and there is no distress. The circulatory asthenic shows distressing features, becomes markedly dyspneic, the pulse rate increases alarmingly, and the recruit is glad to lie down on the bed. After two minutes, the pulse rate in the normal returns to within a few beats of the

preexercise recumbent rate. In fact, it usually is a few beats less, whereas, in the irritable heart, the rate does not come back within two minutes and there is often dyspnea after this period. The so-called effort syndrome, this exaggerated response to light physical exertion and the poor "come-back" is the most characteristic feature of neurocirculatory asthenia. It alone is not sufficient for the diagnosis, because in reconvalence, after inoculation and during certain emotional states, the same exaggerated response is often encountered. Before the diagnosis is made, a very careful history must be taken and the examiner must be very shrewd in judging the timber from which men are made.

Many of the negroes come to us with the diagnosis of "heart trouble" firmly fixed in their minds. They complain of precordial or chest pain, especially when forced to work hard. There is a tachycardia and the pulse reaction characteristic of neurocirculatory asthenia, yet there is something about the case that does not impress one as genuine. The dyspnea is often very marked before exercise. In many cases, the rate of breathing becomes much less after exercise and the exaggerated dyspnea is done periodically, a rest from the strenuous contortions of the abdominal and diaphragmatic muscles being necessary. In these cases, the symptoms are overdone to the point of being grotesque. They are simply cases of simulation; but the pulse rate is up, and if one were to judge from one examination, a discharge would probably be given. We therefore insist on repeated examination, and sometimes catch the malingerer on one of his "off days."

For instance, a negro was recently sent to the cardiovascular board from his infirmary for reexamination and classification. He complained of precordial pain and pain in the back, and found it necessary to stop and rest when the drill period was long, because of "weakness" and "shortness of breath." Close questioning brought out the fact that he had a large crop of cotton at home that needed his attention. His pulse rate standing was 156, and in recumbency 124. After exercise his pulse rate went up to 156, and after two minutes rest in recumbency the rate was 124. The exercise produced dyspnea, which seemed exaggerated. It was largely produced by abdominal muscle work. He was asked to return one week later. On our arrival at the cardiovascular examining room on the appointed morning, we found him clutching a post with one arm, bent over with his other hand on the precordium, and his abdominal muscles working with his diaphragm to produce a dyspnea of almost 60 per minute, a picture of intense distress. The pulse rate standing this day was 140, in recumbency 104, after exercise 140, and two minutes later 104.

The dyspnea after exercise was great, but no greater than before. We finally decided that this man should be put in a labor battalion, for his pulse rate was persistently high. We told the soldier that we had decided that he was unfit for the work of a soldier, which required a man who could keep going even when he got tired and out of breath, but that he was good enough for a labor battalion, to wield a pick and shovel and clean up latrines. We emphasized the fact that he might have to dig ditches under fire and that his only advantage over the soldier was that he could take a rest, even under fire. A surprised look came over the negro's face, and he began to beg not to be put into a labor battalion. He wanted to wear a uniform and carry a gun. He knew that he could stand hard drilling. We promised to give him another examination in fifteen or twenty minutes. In the meantime he was to sit down and rest. When reexamined, not more than half an hour later, his pulse, standing, was 88, recumbent 68, after exercise 120, and two minutes later 88. There was no dyspnea after hopping this time, and what is more important, no dyspnea of the abdominal type before hopping.

3. Oppenheimer, B. S., and Rothschild, M. A.: *The Psychoneurotic Factor in the Irritable Heart of Soldiers*, J. A. M. A. 70: 1919 (June 22) 1918.

We hope that this boy will remain "cured." We believe that the threat of the labor battalion will be a very good prophylactic measure for him and his comrades.

REJECTIONS

The cardiovascular board at Camp Travis has been turning down between 0.3 and 0.4 per cent. of all recruits at the first examination for neurocirculatory asthenia. Later on during the period of training a certain number of men are sent back to the board for reexamination and reclassification, because they have been found to be unable to stand up at drill. At the first examination it is impossible to cull out all, for there is every degree of neurocirculatory asthenia and a small percentage will become fit for the physical exertions of a soldier when carefully trained. When the Ninetieth Division, consisting of about 22,000 men, left Camp Travis for France, about 2,000 men were discarded for physical inaptitude. Of this number, the cardiovascular board picked out fifty as typical neurocirculatory asthenics, that is, about 0.25 per cent. of the strength of the division. This was not the total number of neurocirculatory asthenics with which the Ninetieth Division was embarrassed; a few had been discharged during the training period, and more had been transferred to the depot brigade as inapt for foreign service before the departure of the division. The cardiovascular board has been gradually weeding them out of the camp. They are sent to the cardiovascular board by the infirmary physicians, who well know that these tachycardias are continually being returned to the infirmaries by the company commanders, who can get nothing out of them. In fact, it has often appeared to us that the company commanders are more familiar with the symptoms of neurocirculatory asthenia than the average medical officer. We well remember the remark which one of our friends made before sailing for France with his company. He was describing and discussing the large number of men in his company who could not stand up under hard hikes, who were short winded, and lacked courage and initiative in performing athletic stunts. This officer said:

Don't the doctors know anything about heart diseases? All these men have poor hearts. They haven't any wind; I have sent them back to the infirmary a number of times, but the doctor will never discharge them. I know they will never be any good when we get them into the trenches. I would rather have a company lacking its full quota than to have the quota made up of these men. They are the biggest handicap I have.

His remarks about the doctors were certainly justified. We have been taught to look for anatomic lesions, murmurs denoting valvular defects. Moreover, there was a tendency in the early period of the formation of our army to keep down the number of rejections at all costs, and of course the cost was paid by lowering the quality of the men. When the cardiovascular board first began its examinations at Camp Travis it was impossible to have men discharged from this camp for neurocirculatory asthenia which was termed "simple tachycardia." Consequently these men got into the division. Many of them had to be transferred back to the depot brigade and are being culled out of that organization gradually at present. Some got across and will have to be turned back on the other side. The manual of instructions for the examining physicians says that a constant rate

of 100 or more in recumbency should disqualify. It is a characteristic of the irritable hearts that the difference between the standing and recumbent rate is very large, and many of the typical cases of neurocirculatory asthenia with rates above 120 in standing will go down below 100 on recumbency; besides, the pulse rate alone can never be the only criterion for discharge. The amount of distress after exertion, the history of the case and the appearance of the men are all as important as the pulse rate. At present the cardiovascular board at Camp Travis has carte blanche in discharging its cases. Two hundred and eight men, or 0.38 per cent. of the total number examined, have been discharged for neurocirculatory asthenia. Many of those that we felt should have been discharged during the earlier months of our activity at Camp Travis have since been discharged, either as members of the Ninetieth Division or as holdovers in the training battalion or depot brigade. Some who should have been discharged have no doubt been transferred to other camps. Altogether, we feel that about 0.5 per cent. of all the men arriving at Camp Travis should be turned down for neurocirculatory asthenia. This figure agrees very well with the estimate we have made from the number of cases of neurocirculatory asthenia in the Ninetieth Division, men who were given a fair trial and found wanting after one or two months' service. We want to emphasize again that very few of these men are any good in military service, and we do not believe that very many of them can be made first class soldiers, capable of severe bodily exertion, even when carefully trained. At present there are no special companies for properly training this class of men at Camp Travis, and the only proper procedure is to discharge them as soon as there is certainty of their condition and get them out of the Army. This type of man is naturally disinclined to exert himself. He gets stamped as a malingerer, and very possibly he is of that type; but under no circumstances should the Army be punished for the shortcomings of the man. The Army needs nothing but first class men, and these men are all of them third raters. They are the men who do not succeed in life. They are constitutionally inferior.

There are a certain number of men who, after passing the cardiovascular examination at the camps will pass through a training period as excellent soldiers, and they will go through a part of the campaign in Europe, making good records. Shell shock, gassing, infections attendant on life in the trenches, and lack of sleep, coupled with severe bodily exertion, will make neurocirculatory asthenics out of them. They are of a different type, however, and many, though not all of them, after rest and careful physical training will be returned to their regiments as good or fair soldiers. This type differs from the constitutionally inferior type, which can be culled out at the preliminary examinations. Possibly there is in these cases a certain amount of exhaustion of the myocardium. I saw a large number of these individuals in 1914 at the heart station established by the German army in Nauheim. Many showed a very slight enlargement of the left and right auricular shadows when careful orthodiagrams were made. Electrocardiograms also indicated a slight right ventricular preponderance. These men had been students, office men, business men and in some cases farmers, who had been called from a more or less sedentary life into immediate active service or whose preliminary training had been insufficient for the ter-

rific physical exertion they were called on to undergo. They gave a history of having been forced to march up to 40 kilometers a day in the advance toward and the retreat from the Marne with insufficient nourishment and sleep, and burdened with heavy packs. This resulted in symptoms of breathlessness and precordial pain, inability to sleep, and a soft systolic murmur at the apex which we believe of little significance, and this very slight bulging of the left and right auricle shadows of the heart. The orthodiagraphic work was done by a man who helped to develop orthodiagraphy with Mortiz and who has done this work in an extremely careful way in thousands of cases. There was no question of there being a slight rounding of the figure of the heart, and there was no question about many of these cases showing a slightly depressed Q R S group in Lead I and a high Q R S group in Lead III, all indicative of a period when myocardial insufficiency had been present with regurgitation back through the mitral orifice. Under proper treatment many of these men apparently recovered full myocardial efficiency. It is interesting to note that there was no change in the orthodiagrams or electrocardiograms after the return of apparently good function.

There are a few cases of tachycardia that cannot be classed as hyperthyroidism because the other symptoms of this condition are not to be found. Neither can they be classed as neurocirculatory asthenia, for the typical history and precordial pain is not present. Usually the pulse rate does not go down as far in recumbency as it does in the typical cases of irritable heart. We classify such cases as persistent tachycardia if it is present at repeated examination, and then discharge the men; for it is evident that such hearts "will not stand the gaff." Evans demonstrated some years ago that a heart consumed more energy doing the same amount of work per minute when the pulse rate is rapid than it consumes when the rate is slow. For this reason a heart working at a rapid rate becomes exhausted more rapidly than a heart doing the same circulatory work, but at a slower rate. A slow rate is the characteristic of the well trained athlete's heart. It is a rule that men with persistent tachycardia cannot hold out, other things being equal. The possessor of a heart rate persistently above 100 should be discharged or given deferred classification.

CONCLUSIONS

1. The incidence of aortic insufficiency in Texas and Oklahoma is about 0.1 per cent. between the ages of 21 and 31.
2. Uncomplicated mitral insufficiency of endocarditic origin is comparatively rare, being probably not much greater than 0.1 per cent. for men between 21 and 31.
3. Accidental systolic murmurs at the apex are very common, about 3 per cent. of all men showing them, and they are of practically no significance, unless accompanied by signs of hypertrophy and increased pulmonic pressure.
4. Neurocirculatory asthenia is the most important cardiovascular disease in our army. At least 0.5 per cent. of all the drafted men should be rejected for this condition before the various divisions sail for France.
5. The incidence of mitral stenosis is about 0.02 per cent.; of idiopathic hypertrophy, about 0.01 per cent.; of hypertension, 0.02 per cent., and of hyperthyroidism, 0.015 per cent.

BLOOD-CLOT DRESSING IN MASTOIDECTOMY

MODIFIED TECHNIC WHICH ASSURES PRIMARY
PAINLESS HEALING WITHOUT DEFORMITY—PRELIMINARY REPORT

GEORGE E. DAVIS, M.D.
NEW YORK

I wish to add my observations and experience to those of Blake, Reik, Holmes and others in perfecting the technic of the blood-clot dressing in mastoidectomy, a method, I feel, that is destined to revolutionize the after-treatment of mastoiditis.

Recently in a historical review of the institutes of surgery, Sir Berkeley Moynihan¹ observed that "a discovery is rarely the work of one mind. It is one observation added to another that makes the supersaturated solution from which the crystal of truth at last precipitates." This observation was evoked by an allusion to the respective share or credit of Lister and Pasteur for the discovery of the antiseptic system. Moynihan added that "Lister never ceased to give credit to Pasteur for his share in the work that led finally to the development of the antiseptic method."

The foregoing citation is peculiarly apropos to the theme of my text, since the key to the successful employment of the blood-clot dressing in mastoidectomy is wholly dependent on a perfect antiseptic technic, especially as we are dealing always with an infected wound in mastoiditis. The value of the "organized blood-clot" in the healing process was discovered by the greatest of original observers of pathologic conditions, the immortal John Hunter. Long afterward the technic of the blood-clot as a dressing was exploited and made practical use of in surgery on the continent by Schede and subsequently, in this country, by Halsted, Senn, Ochsner and others.

Credit is due Blake of Boston, who, at the suggestion of Sprague of Providence, R. I., first employed it in mastoidectomy. But especially to Reik of Baltimore must be ascribed the most credit for the development or popularizing the blood-clot dressing in mastoidectomy.

Briefly, the technic of the blood-clot dressing as originally practiced in mastoidectomy was to eradicate as thoroughly as possible all diseased tissues, observing strict asepsis, and the blood-clot was admitted at the time of the operation.

The cardinal error of this technic was brought home to me by an observation and experience I had in a radical frontal sinus case which I reported, with the presentation of the patient, to the New York Academy of Medicine in March, 1918, and, by the way, the first and only case on record, so far as I know, in which the blood-clot method was used in this location—the frontal sinus.

In this case a radical Killian operation was done. After removal of the anterior sinus wall, it was observed that the entire sinus floor was necrosed and that there was the complication of a foul postorbital abscess. The necrosis extended so far into the orbital arch that it was necessary to remove this also. The postorbital abscess cavity and the sinus cavity were packed with a continuous strip of iodoform wool and the wound closed, one end of the packing being left protrud-

1. Moynihan, Sir Berkeley: *Brit. Medicine in the War, 1914-1917*, Tr. Brit. Med. Assn., 1917.