ago and was found to have mitral stenosis and regurgitation with auricular fibrillation and a continuously irregular pulse. Since his discharge he has done two years' continuous work with one interruption of three months. His work involves standing for many hours a day and constantly running up and down the staircase of an omnibus. He has taken digitalis continuously during these two years and says that he is entirely dependent on the drug.

The following case of myocardial degeneration with auricular fibrillation responded well to digitalis, although the patient was a man of 70 years of age.

J. W., aged 70, metal smith, was admitted into the Queen's Hospital on June 7th, 1911, suffering from shortness of breath, cough, and expectoration of gradually increasing severity for the past four years. On admission there was orthopnoea, cyanosis of the lips and ears, oedema of the legs, a large pulsatile liver, an enlarged spleen, and a rapid, small, continuously irregular pulse. Both ventricles were of large size, but the emphysematous condition of the lungs made it difficult to define the exact boundaries. There was a systolic murmur at the apex, audible in the axilla and at the tricuspid area. After twelve days' rest in bed, without drugs, the oedema had disappeared, but the pulse remained at about 90 per minute. A week later, after taking two granules of Nativelle's digitaline per day, the pulse had slowed to 60 per minute. Coincidentally with this slowing the general condition of the patient greatly improved, and five weeks after his admission he left the hospital. All the cyanosis had gone, cough and expectoration had ceased, and the patient was able to mount stairs without any discomfort.

The following is a case of myocardial degeneration with auricular fibrillation in which the patient improved under digitalis in spite of the fact that he had cancer of the liver.

T. H., aged 56, bricklayer, was admitted into the Queen's Hospital on August 23rd, 1911, with carcinoma of the liver and a failing heart, evidenced by shortness of breath, cyanosis, oedema of the legs and back, ascites, and a continuously irregular pulse of very small amplitude, of about 100 per minute. Both ventricles of the heart were enlarged, but emphysema made an exact definition impossible. There were no murmurs. Rest in bed without drugs for six days did not improve the condition of the circulation, but six days later, after having taken 29 granules of digitaline, the pulse was 57 per minute, and of good volume, all cyanosis and oedema had disappeared, and the ascites had diminished. A month later still, on 1 granule of digitaline per day, all ascites had disappeared, and the patient could mount stairs without any discomfort. This improvement in the heart's action has been maintained until the present time, although the patient is losing strength and flesh as the result of malignant disease of the liver.

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THE MANAGEMENT OF CARDIAC FAILURE IN DIPHTHERIA.

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THE rational treatment of all forms of cardiac failure is to remove the cause or causes whenever possible; at the same time to consider the pathological changes in the cardio-vascular system with a view to amelioration of such changes; lastly, to consider the clinical aspect with a view to tiding the heart over the period of stress and preventing or relieving serious symptoms. With regard to the causal factor in diphtheria, it will generally be admitted that the action of the toxin on the heart muscle, resulting in certain degenerative changes, is the main cause of failure. The result of this action, though it can largely be prevented by the early, free administration of antitoxin, cannot be remedied once it has taken place. Unfortunately, in too many cases the antitoxin is not administered until the patient is admitted to hospital, often as late as the fourth or fifth day of the illness. The consequence is that valuable time is lost, and the main cause of cardiac failure may be beyond control. With reference to subsidiary causes, the early loss of appetite which so frequently occurs in diphtheria is a predisposing cause; whilst, on the other hand, the feeling of malaise probably exerts a beneficial influence, inasmuch as it necessitates rest, and so diminishes the heart work. That this point is of some importance seems evidenced by the fact that many patients who are conveyed by ambulance over considerable distances show on admission definite signs of cardiac depression, which pass away after a night's rest.

There are, of course, many other factors tending to cause cardiac failure which may come into play in the case of adults suffering from diphtheria, but the main cause is the specific toxin, and it is largely under our control if adequate treatment is commenced early enough.

PATHOLOGICAL INDICATIONS.

Seeing that the changes which occur in the heart muscle are degenerative in nature and are so rapid, they furnish few indications for treatment. It is important to note, however, that in those cases characterized chiefly by failure of tonic eliminative treatment by purgation and leeching is not only useless, but positively dangerous.

CLINICAL INDICATIONS.

Unfortunately we frequently see cases in which the causal factor has passed beyond our control, and we must rest content with expectant treatment. We therefore attempt to assist Nature in her efforts to promote resistance sufficiently prolonged for the patient to throw off the disease, at the same time guarding against possible complications—thus, by the rational administration of food and stimulant (if required), attention to sleep, and to the excreta, we endeavour to tide the patient over the crisis.

With reference to complications affecting the circulation, undoubtedly the most serious is that type of cardiac failure associated with persistent vomiting. It is so fatal and its early recognition so important that I append a note on its differential diagnosis. When a patient suffering from severe diphtheria begins to vomit after the seventh day of the illness, we must remember that there are several possible explanations; thus, it may turn out that the dreaded cardiac vomiting has supervened, whilst, on the other hand, the vomiting may be due to the onset of scarlet fever. It is not possible to exclude scarlet fever with certainty at the commencement, as it sometimes begins with vomiting, associated with a normal or sub-normal temperature. However, a few hours generally makes the diagnosis clear. Measles may also commence with vomiting, and the fact that it is frequently afebrile in its very early stages and not infrequently commences without even coryza or suffusion of the conjunctiva may mislead one, unless a sharp look-out is kept for Koplik's spots.

Serum reaction may commence with an attack of vomiting and cardiac depression (especially the urticarial type of serum rash), but here again the lapse of a few hours generally clears up the diagnosis.

"Cardiac" Vomiting.

The following signs indicate the probability of myocardial involvement:

1. *Certain Types of Faucial Attack.*—When the faucial attack is severe and is complicated by involvement of the naso-pharynx and palate, the probability that the onset of vomiting may indicate commencing cardiac failure is considerable.

2. *Rapidity of the Pulse.*—It is generally recognized that in simple febrile conditions, for every rise in temperature of 1° F. there is corresponding increase in the frequency of the pulse of 10 beats per minute. Whenever in diphtheria the pulse-rate increases out of proportion to the rise of temperature, involvement of the myocardium may be suspected. This sign, which was observed by Dr. Caiger many years ago, is one of the earliest and most reliable indications of threatened failure.

3. *Auscultatory Signs.*—The presence of the extra-systole with or without a consecutive intermission of the heart's action is also important evidence that the heart wall is involved in the morbid process. It carries with it a grave prognosis, when it first appears between the seventh and seventeenth days, but when it commences after the first three weeks its prognostic significance is more favourable. In addition to the above, reduplication of the first sound, followed by accentuated second, is a sign of advanced myocardial disease, as is also marked approximation. On the other hand, shortening of the first sound, accompanied by prolongation of the interval between it and the second sound, is an indication of less advanced disease. Lastly, in some cases in which the function of contractility is depressed, the heart sounds may become almost inaudible.

4. *Anginoid pains* occur, and are strong evidence of myocardial failure. Adult patients voluntarily complain of intermitting pains in the left arm, associated with a sense of constriction in the chest. Small children may suffer from pain during the stage of cardiac vomiting, and it is frequently referred to the abdomen, especially the epigastric region. Its cardiac origin may be suspected when it is relieved by hot applications to the precordial region.

5. *Urine*.—The amount secreted rapidly diminishes, and there may be complete suppression. Albumen may be present. It is commonly averred that albuminuria is an early and characteristic sign of diphtheria. Our experience, however, goes to prove that it is found in the more serious type of case only. It is consequently of less value as a diagnostic sign than is commonly stated.

6. *The Liver* is generally enlarged.

TREATMENT.

Treatment of patients suffering from cardiac failure accompanied by persistent vomiting should be conducted on the following lines:

1. *Position of the Patient in Bed*.—The head should be low to prevent cerebral anaemia, while the foot of the bed should be elevated. This may help retention of the rectal feeds.

2. *Clothing*.—Patients during the stage of cardiac depression become restless and throw off the bedclothes. They should therefore be warmly clad, and for the same reason hot-water bottles should be placed in the bed.

3. *Nourishment*.—All food by the mouth should be stopped and nutrient enemata administered. The rectum should be irrigated twice daily with warm boracic solution, otherwise irritation may be set up, and retention of nutrients become impossible.

Treatment of the Cardiac Depression.

This must be combated by the administration of medicines. Various drugs have been used for this purpose, chief amongst them being strychnine, belladonna, and adrenalin. Since administering them in combination hypodermically we had four successful cases, though, of course, we have also had our failures. The formula used is as follows:

Atropine sulphate	...	...	100 gr.
Strychnine hydrochloride	...	...	100 gr.
Adrenalin chloride solution (1 in 1,000)	...	...	5 m.
Aq.	...	...	ad 10 m.

To be administered hypodermically every four hours.

That the above-mentioned combination exercised a beneficial influence on the favourable course the cases followed I am convinced, and in this opinion I am supported by Dr. Foord Caiger, who watched the cases with me from the very commencement.

Treatment of Urgent Symptoms.

Thirst.—This is first met by the administration twice daily of small enemata of normal saline solution, whilst teaspoonful doses of iced water may be allowed as soon as the vomiting ceases.

Dryness of the Mouth may be alleviated by the application of such remedies as glycerine and boracic acid, half strength.

Pain is most rapidly relieved by the frequent application of hot fomentations to the precordium.

Constipation.—It may be necessary to obtain an action of the bowels, and it is important to bear in mind that, owing to the serious cardiac depression, all purgatives are contraindicated. For this reason small enemata of glycerine and water are preferable.

CASES OF CARDIAC VOMITING WHICH RECOVERED UNDER THE TREATMENT ADVOCATED.

CASE I.

R. C. M., aged 8 years, was admitted to the South-Western Fever Hospital on October 26th. He had been quite well on October 21st; on October 22nd he vomited and complained of sore throat; and on October 24th swelling of the cervical glands, nasal discharge, and cough were observed.

On admission a deposit of thick opaque membrane completely covered the inner surface of both tonsils and extended to the uvula. There was also general swelling and oedema of the fauces. The cervical glands were much enlarged and rhinorrhoea was profuse. The heart apex beat in fifth interspace in left nipple line. The heart sounds a little sharp and spaced. Pulse 114; 12,000 units of antitoxin were injected and strychnine and brandy administered by mouth. October 27th: The edges of membrane are beginning to curl up, physical signs remain

unchanged, no albumen in urine. 8,000 units of antitoxin administered. October 28th: Membrane shows signs of disintegrating; cervical glands less swollen; physical signs in heart unchanged, but albumen one-eighth present in urine. Pulse 96; temperature normal. October 29th: Membrane peeling off. No change to note except that pulse is more rapid, 112. The patient progressed without material change until the evening of November 4th, when he complained of not feeling so well. November 5th: Patient collapsed, inclined to vomit, general condition bad, surface cyanotic and extremities cold. The apex beat was well inside the left nipple line; the first sound showed the characteristic reduplication. Lower border of liver below the costal margin. Only passed 8 oz. of urine; albumen present. Treatment as above. November 6th: Patient vomiting persistently. Tongue dry. Extremities cold. Hepatic enlargement remains. Pulse 130; temperature subnormal. November 7th, 8th, and 9th: Vomiting continuous. Pulse almost imperceptible at wrist. November 10th: Only vomited once. Liver enlargement less marked. November 11th: Vomiting ceased. Tongue moist and cleaning. Pulse 108, much stronger. November 12th: Pulse 96, force good, rhythm regular. Passed 14 oz. of urine. November 13th, 14th, and 15th: No recurrence of vomiting and patient able to take food by mouth in sufficient quantities; felt much stronger. Urine increasing in quantity. November 16th: Complains of "pins and needles" in feet. During the next six weeks the patient suffered from paralysis of the muscles of accommodation, and ocular movements were paralysed, as also were the constrictors of the pharynx, adductors of the larynx, and also the diaphragm. Eventually the patient made a good recovery and was able to leave his bed for a short time on December 28th.

CASE II.

E. P. was admitted on February 27th with the usual history, and a copious exudate on tonsils and uvula. On March 7th she commenced to vomit, and showed the usual signs of cardiac depression, with oedema and dilatation. Rectal feeding was ordered, together with four-hourly injections of the solution of atropin, strychnine, and adrenalin; vomiting ceased after the second day of treatment, but the signs of myocardial involvement lasted for several weeks. Finally, after passing through a severe attack of post-diphtheritic paralysis, she eventually recovered.

CASE III.

W. L. G., aged 3 years and 2 months, was admitted on April 21st. The history was that he had vomited on April 12th, had sore throat on April 20th, and on April 21st swelling of cervical glands. On admission, there was injection of the fauces, an exudate covering either tonsil, and profuse rhinorrhoea; 12,000 units of antitoxin were administered, but the membrane continued to spread. On April 22nd vomiting commenced, and signs of cardiac failure, associated with a dilated left ventricle, appeared; the patient continued very ill for some days, showing most of the signs of cardiac depression above enumerated. Eventually the vomiting ceased and the heart gained in strength, and the patient made a gradual but satisfactory recovery. It is of interest to note that this patient suffered from several attacks of epistaxis, and several petechial spots appeared on the neck.

CASE IV.

A. T., aged 28 years, was admitted on July 3rd with the following history:—June 30th: Headache and sore throat. July 2nd: Cervical glands enlarged. On admission examination revealed extensive exudation covering both tonsils, which were so swollen as to almost meet in the middle line. The exudate also extended to the uvula and soft palate. Submaxillary glands much swollen on both sides. Heart sounds normal. Pulse 76, colour good; 16,000 units of antitoxin were administered. July 4th, 5th, and 6th: Exudation no less, otherwise not any change. July 7th: The patient feels better, the greater part of the exudate has separated. July 8th, 9th, and 10th: No change except that the patient had some difficulty in opening his mouth, in spite of the cervical glandular swelling having disappeared. July 11th: Persistent vomiting since early morning, patient collapsed. Heart sounds very weak, occasional extra systoles present. July 12th: Vomiting still. The apex beat was inside the left nipple line; the heart sounds weak; extra systoles followed by intermission. Some complaints of throbbing and feeling faint. Urine 13 oz., heavy deposit of albumen. July 13th: No more vomiting; pain in arm running down to wrist associated with a sense of tightness across the upper part of the chest; the pulse was intermittent; no extra systoles; impulse no stronger. July 14th: Cardiac action stronger; no vomiting. Heart sounds rather spaced, albumen still present. July 16th: Complained of cardiac pain after an enema. No signs of dilatation; no vomiting; heavy deposit of albumen. July 17th: No more pain; no vomiting; thick deposit of albumen. July 19th: Heart action much stronger, but first sound reduplicated; albumen less. July 22nd: Heart action regular; no albumen; no bad symptoms. July 26th: No albumen in urine; sounds at cardiac apex weak but pure. From this date cardiac action gradually became normal, but the patient did not escape some degree of paralysis.

The above case is one in which the cardiac affection was failure of contractility. It is of importance, as it indicates that recovery from such a grave condition need not be despaired of.

Dr. Caiger has kindly allowed me to use the notes of the above cases.