circulation becomes efficient; this process is accelerated by using an elastic bandage locally at night. The feet may be swollen in the morning and the swelling subside after a day's work, thus affording interesting evidence of the action of the muscles on the deep circulation. The muscular tone improves greatly, but it has not been actually measured. Measurements by a tape on different days are apt to be misleading, but are sometimes useful if, on the same day, a comparison is made between a treated and an untreated limb. When all symptoms and signs are absent and the health is improving the final result has been assessed as perfect; then follow excellent, very good, good, fair, and failure. A family history of varix does not seem to affect the result, but varix when familial tends to increase. Speaking generally, in the severe types the older the patient the better the result. The oldest male to be treated was 75, and the oldest female 74. The man had enormous multiple varicosities from groin to ankle, and said that he had spent £170 on elastic stockings during the last thirty-five years; his work as a blacksmith had been hard on them. Eight injections cured the right and four the left limb.

Curious coincidences have been noticed here and there—for example, symptoms of dizziness, deafness, and light-headedness, especially in old persons, have cleared up. Whether the obliteration has a definite effect on the blood pressures or not, especially on the diastolic pressure as one would expect, will require to be worked out. If it has, then the method may have a wider application than it has at present.

Two cases in this series merit attention.

CASE I.

The patient, a man aged 56, was treated for varicose ulcer of the right leg, and an enormous condition of varicosities of the whole of both lower limbs. The ulcer at this time was nearly healed. Six injections of 40 per cent. salicylate (10 per cent. saline) from January 2nd until April 4th resulted in complete obliteration of the varices on the right side. On April 27th the first injection of 40 per cent. salicylate (10 per cent. saline) was given on the front of the left leg. A maximum immediate effect was produced. The patient went to work for a week. On May 5th he had pain in the back and chest and did not go to work. There was no cough or sputum, and no history of shivering. He remained in and out of bed, and on May 9th was admitted to a medical ward suffering from acute bronchitis, which was considered to be influenzal in origin as there was an epidemic at the time. Moist sounds could be heard over the whole of the chest. The patient died on May 10th. No post-mortem examination was allowed.

CASE II.

This patient, an unmarried woman of 32, was under treatment for a medium degree of varicosity of the left side. On February 23rd and March 9th injections of 40 per cent. salicylate (10 per cent. saline) were given. A medium immediate effect was obtained. On March 13th the patient had a right-sided hemiplegia from which she has made a good recovery. A sister had previously also had a hemiplegia. There was no gross cardiac disease.

These two are the only cases in the series in which any serious complication could be considered as possibly due to the treatment.

Conclusions.

Finally it appears in the light of the clinical results that the descriptive anatomy requires amplification. We want to know from injections and sections of the limbs in the dead subject the relative blood volumes of the superficial and deep veins in health and in conditions of varix. A plethysmographic record in old cases of white leg would help to tell us the carrying capacity of the deep veins. The pain seems to be due not to the saline in the solution but to the salicylate alone. If those who use the saline method would try it with small additional strengths of salicylate added, it might be possible to find an ideal solution which would produce the maximum sclerosis, and only a slight but definite tingling at the time of injection.

In my experience the results of using local analgesics in the salicylate solution have, while allowing as far as possible for the unknown factors in the deep circulation, been entirely negative. As Barber¹¹ points out, their use might prevent the recognition and rapid evacuation or dilution of an extravasation. At present it seems clear that no

great advance will be made until we have records of consecutive cases kept by different injectors on some comparable system and observed at greater leisure than is usually possible in busy hospital departments. The fact that in the majority of cases we can give in advance an approximate estimate of the number of injections required and can tell the probable distribution of the sclerosis makes the salicylate-saline method a very good one.

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SOME OBSERVATIONS ON BERI-BERI.

BY

ALEXANDER CANNON, M.D. LEEDS,

TEACHER OF MORBID ANATOMY, UNIVERSITY OF HONG-KONG;
PHYSICIAN, COLONIAL MEDICAL SERVICE.

THE following conclusions have been formed as a result of two years' research work on over six hundred patients of Chinese nationality, and more than eighty post-mortem examinations, as well as animal experiments.

1. Beri-beri is a syndrome of the Orient, confined to Orientals, chiefly males; seasonal in occurrence; prevalent during the wet season; partly infectious; a rice "disease"; and is brought about by three factors. They are: (a) water-soluble vitamin B deficiency; (b) a bacterial infection, closely resembling or identical with the *Bacillus asthenogenes* of Bernard (1919); and (c) endocrine organ disturbance.

2. A low cholesterol content of the blood is also essential to the occurrence of this syndrome.

3. The diagnosis and prognosis can be assisted by x-ray examination.

4. The pathology is specific.

5. Bernard's complement fixation test is a valuable aid to diagnosis.

6. Beri-beri may be either acute or chronic. The "dry" and "dysenteric" beri-beris are really camouflaged forms of malaria, as proved by the invariable findings of the specific malarial parasite on every careful examination.

7. The blood pressure and the cerebro-spinal fluid pressure have definite constant variation. In acute cases the blood pressure is always below normal, about 80, and the cerebro-spinal fluid above normal, about 200.

8. Magnesium sulphate, given daily in doses amounting to 150 grams, administered as twenty-four half-hour doses during the twelve waking hours of the day, and repeated, if necessary, on the two following days, together with 1/2 c.cm. of pituitary extract (B.W. and Co.) twice daily; also hypodermic injections of 1 c.cm. of a 5 per cent. solution of cholesterol in olive oil, given on alternate days for six to ten injections, bring about speedy amelioration of the symptom and sign complex; and, with the addition to the diet of vitamin B, complete the cure. Bernard's serums can also be used with good results.

9. Patients with beri-beri can take a large amount of sugar without it appearing in the urine, their capacity being about twice that of a normal individual.

10. The syndrome occurs almost solely in males; there are a few exceptions to this, as to every rule, but they are very rare. It comprises the following manifestations:

(1) Swelling of the feet: in China the complaint is known as "ker' k'i," meaning humidity of the feet.

(2) Swelling of the face: especially under the eyes, as in kidney disease (acute parenchymatous nephritis does occur).

(3) Swelling of the abdomen—ascitic.

(4) "Swelling" of the heart: detected by clinical methods and x rays (Reinhard, 1916).

(5) The blood pressure is lower than normal, being inversely proportional to the "disease."

(6) The patients are unable to rise from the squatting position without help, or by the aid of "crawling up their legs" with their hands, just as a person suffering from pseudo-hypertrophic paralysis does (Willcox, 1915).

(7) Knee-jerks are usually absent, but may be grossly exaggerated (Darling, 1914).

(8) Tenderness is elicited on deep pressure over the nerve trunks.

Other signs and symptoms which may be present in a large number of cases are:

(9) Numbness of the feet.

(10) Bad taste in the mouth in the morning: probably caused by the resultant dilatation of the stomach owing to its asthenic condition.

(11) Respirations are shallower than normal.

(12) Vertigo may occur.

(13) The patient may complain of severe pain in the legs.

More remote signs and symptoms observed are:

(14) Sensation of faintness.

(15) Loose motions.

(16) Inability to walk.

(17) Slow pulse in convalescing cases.

(18) Skin whiter than normal.

(19) The respiratory quotient does not exceed 0.8 and is often only 0.7 (normal 0.9 to 1.0).

(20) The blood urea is usually 1 gram or more per litre of serum (normal is under 0.5).

THE CAUSAL FACTORS.

Three causal factors have been cited; they are as follows.

1. Vitamin B Deficiency.

The works of Funk (1911), Fraser and Stanton, McCarrison, and many others strongly favour this as a cause. The pericarp of "red" rice contains vitamin B. Darling's work in 1914 lucidly explains the relationship between beri-beri and other deficiency diseases as revealed in Fig. 1. Woolard¹ produces evidence strongly in favour of the deficiency disease theory. I have also satisfied myself that the bone conditions are similar in appearance in the various deficiency diseases.

The three important processes of growth in bone are:

(1) growth and ossification of the cartilage between the

FIG. 1.—Diagram showing the relation of beri-beri to other deficiency diseases. The circles from above downwards represent: 1, rickets; 2, infantile scurvy; 3, scurvy of guinea-pigs (large circle); 4, scurvy (smaller circle); 5, ship scurvy; 6, polyneuritis avium; 7, beri-beri. The shaded portion indicates the position of beri-beri.

epiphysis and shaft; (2) enlargement of the marrow cavity, which is effected by absorption of the inner layers of the shaft; (3) increase in thickness of bone due to deposition of bone by the inner layers of the periosteum. In rickets, which occurs in early life, the process in (1) is exaggerated; in (2) it is more rapid than usual; whilst in (3) the growth is defective and uneven. This results in a larger medullary cavity and a thinner shaft than normal, but a great excess of cartilage at the epiphyses.

Now beri-beri ("infantile beri-beri" is not included as it is another disease) occurs in adult life, when the normal processes have continued until the onset of the syndrome;

this results in an enlarged medulla at the expense of the thickness of the shaft bone, but cartilage growth, which has long since ceased, remains unaffected by any degenerative process.

2. A Specific Bacillus.

This is probably the *B. asthenogenes*. My colleague C. Y. Wang, professor of pathology in the University, states that "this organism gives all the essential characteristics of the *B. cohaerens* of Göttlieb." Elsewhere² I have given the full bacteriology of this organism, and experimental proof of its relationship to beri-beri. Suffice

FIG. 2.—The *Bacillus asthenogenes* of Bernard. Bouillon cultures twelve hours old (anaerobic and aerobic).

it to say that it exists in two forms: aerobic and saprophytic in the presence of vitamin B; and anaerobic and pathogenic in the absence of water-soluble vitamin B.

The toxin is obtained by filtering through a Pasteur-Chamberland filter candle No. 4. A 1 c.cm. dose of the filtrate injected into the vein of the ear kills a rabbit averaging 1,800 grams in weight. For research purposes Bernard concentrates this toxin and obtains a product which kills by a constant dose of 1/20 c.cm.

The bacillus can be isolated from human blood for anaerobic culture in a medium consisting of bouillon and milk in equal parts. Only when gastric symptoms exist and at irregular periods can the bacillus be found in the peripheral circulation. In cases of paralysis it is absent, just as the Klebs-Loeffler bacillus is absent in diphtherial paralysis. It can always be found in the spleen.

Various serological researches are carried out by taking a culture of twelve hours' growth and centrifuging. The bottom of the centrifuge is diluted with saline to 0.5 per cent. strength. The best culture medium is pork 25 grams and saline solution (0.5 per cent.) to 100 c.cm. The suspension should be sterilized at 120° C.; 15 c.cm. of milk is then added, followed by 10 c.cm. of a fresh culture (twelve hours' growth), and the whole is heated to 37° C.

The fixation of complement and agglutination test of Bernard is performed with the same culture. For agglutination an emulsion of the microbe is made in 0.5 per cent. saline solution, and is then adjusted to pH 6.5 and heated to 45° C. Agglutination occurs after five hours. For certain diagnosis agglutination only above 1 in 150 must be considered. (Other serums 1 in 50 and 1 in 100.)

3. An Endocrine Disturbance.

The relative mental dullness and possible myxoedematous appearance suggest an endocrine disturbance, as do the cases of insanity associated with beri-beri (70 in 290). As regards the morbid anatomy of these endocrine glands in beri-beri, the pancreas appears normal, but the islets of Langerhans are much hypertrophied; their function has been shown to be increased. The suprarenals are hyperaemic; there is hypertrophy of the cortex without degeneration, and the medulla is hypertrophied, with marked round-celled infiltration around the vessels; hyaline bodies are also present. (Comissati's chemical method estimates an increased secretion of adrenaline.) The prostate is congested and enlarged; the thymus is present and increased in size. The pituitary body is unchanged, and the

remaining organs are atrophied. (In all cases of sudden death, as in beri-beri, the thymus is enlarged.)

Low Cholesterol Content.

The Chinese normal cholesterol content is 0.62 (European 0.68). Women usually escape infection, probably owing to the regular menstrual cycle, which occurs about thirteen times yearly, each cycle being accompanied by increased cholesterol content of the blood. In gall-stone patients the content is raised, and I have never yet found evidence of beri-beri in a cadaver in which gall-stones were present (I examine about 1,500 adults and 2,500 children yearly).

X-Ray Diagnosis.

The pulmonary vessels and right side of the heart are enlarged first; then the left side of the heart enlarges. When convalescence commences, first the left side and then the right side clears up, and finally the pulmonary vessels resume their normal size.

Post-mortem Landmarks.*

"Water here, water there, water everywhere" well describes the condition of the body. Rigor mortis is either very rapid or very slow in onset (normal average 4 hours onset to 36 termination).

The heart looks fatty, and the heart muscle resembles bad beef; the right ventricle may be three times the size of the left. The lungs, stomach, intestines, bladder, and spleen are congested and oedematous. The kidneys show acute parenchymatous nephritis.

The nerve changes fall into three groups: (1) Changes without interruption of continuity. These are analogous to cloudy swelling affecting both axis cylinder and medulla; found in early stages. The condition terminates in (a) complete restoration, (b) advanced degeneration, or (c) atrophy in course of time. (2) Changes with interruption of continuity. The nerve changes are not diffused but are

*The detailed pathology is given in a communication to the *Transactions* of the Royal Society of Tropical Medicine and Hygiene.

localized in patches. All degrees of degeneration may be seen together, and the medullary sheath is fragmented. The continuity of the axis cylinder is not broken, but it may be charged with coarse and fine granules. There is little functional loss. (3) Atrophic changes occur later. The nerve bundles are greatly shrunken, with atrophy of the medullary sheaths. The axis cylinders are narrow and uneven, and the interstitial tissue is increased. Function is greatly disturbed. The arteries show irregularity of the tunica media, with spaces between the cells.

Blood count: finely granular oxyphils, 60 per cent., coarsely granular oxyphils, 5 per cent., basophil leucocytes 0.5 per cent., hyalines 20 per cent., lymphocytes 14.5 per cent.

The muscles show fatty degeneration, and there is often marked atrophy of the peroneals. Two forms of changes are to be differentiated: a primary change caused directly by the Kakke toxin, and a secondary one, the result of changes in the nerve supply.

The organs of the body have antineuritic powers in the following order: liver, heart, cerebrum, cerebellum, and voluntary muscle.

Oedema is most marked at the auriculo-ventricular junction in the heart. Atrophy is most marked in the testicles. Keratomalacia is found in some cases. Corneal opacity may suddenly appear and end in panophthalmitis. The administration of fat-soluble vitamin A quickly arrests this condition in the early stages.

In my opinion it is the vitamin deficiency which renders the body very liable to be overrun by the rank growth of bacteria, and this is the pivot upon which we should base our further researches.

I wish to thank Dr. P. Noel Bernard and his staff for their courtesy to me and kind help while in Indo-China and China; also Dr. C. Y. Wang for his confirmatory work on the bacteriological aspect of my researches.

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ASPIRATING THE CONTENTS OF THE STOMACH.

BY

HAMILTON BAILEY, F.R.C.S.ENG.,
SURGEON, DUDLEY ROAD HOSPITAL, BIRMINGHAM.

WASHING out the stomach of a desperately ill but fully conscious patient ranks high among the most distasteful tasks in surgery; it is only natural to shrink from adding to the discomfort of the patient. Misdirected compassion, or fear of still further upsetting a patient who is already in a critical condition, may be determining factors in withholding the stomach tube in cases where it is strongly

will enable them to do so. Once the tube is in position the stomach contents can be aspirated with a syringe. A bladder syringe answers the purpose, but a well-fitting glass syringe, such as that shown in Fig. 2, makes for a perfected technique. After the contents have been aspirated the organ may be washed out with boiled water, or anything else which is thought desirable. No one who has had experience with the large red rubber tube, funnel, jug, and mackintosh apron would wish to return to them.

FIG. 1.

FIG. 2.

indicated—a form of conservatism which is often the antithesis of good judgement.

In those conditions where emptying the stomach may prove a life-saving measure the contents of the organ are known to be of a watery consistency; acute dilatation of the stomach, intestinal obstruction, and vomiting after gastro-jejunostomy are but a few of such conditions. The question which arises is, Why employ a large calibre tube to evacuate a watery fluid?

Ryle's small stomach tube (Fig. 1) can be swallowed without overwhelming discomfort and without shock. In the few patients who find that they cannot swallow the tube a little 10 per cent. cocaine sprayed on the pharynx

Speaking personally, I look back with a shudder on the older method, and every time I see the stomach contents being quietly and painlessly and effectively aspirated I experience a feeling of gratitude to Dr. Ryle for his invention.

Having once gained familiarity with the method one finds increasing fields of usefulness for gastric aspiration. Not only does the need for jejunostomy grow less, but there will be found occasions where the method may be employed as an aid to urgent diagnosis.

This note does not claim to express anything original; it is rather a plea for the more universal adoption of a very satisfactory principle.