Kakke,
A Study of Disease in Japan,

A Thesis,
Presented to the University of Edinburgh,
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In presenting to the University of Edinburgh a Thesis for the Degree of Doctor of Medicine, it has seemed to me that I could not find a more appropriate theme than some aspect of disease, which has presented itself to me in practice in Japan during a residence of nearly ten years in that country. Such a practice affords opportunity of seeing some diseases which do not occur in Europe, or are not frequent. Among these the most important is that which I have selected for the subject of my Thesis.

The practitioner in a distant land has many difficulties to contend with. The initial one of the language of the people having been overcome, he has to deal with much prejudice and gradually to win the confidence of the people. Abroad more than at home there are difficulties in the way of keeping patients sufficiently long under observation, and of inducing them to submit to or to carry out the treatment determined upon. The field of Pathology is very much limited by the difficulty of obtaining permission for an autopsy. In serious cases one feels the absence of medical colleagues with whom

to confer, or even of a good library to consult. I may add that a busy practice of from four to five thousand patients annually, many of whom demand careful study, and many, surgical intervence, does not admit of much leisure for keeping records. In my own case I had the additional calamity of losing all my clinical note up to Nov. 1879 in a fire in which the dispensary and Hospital were destroyed. I mention these circumstances as some apology for the deficiencies of which I am conscious.

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Kakké.

One is not long in Japan before hearing both from foreigners and Japanese of a formidable and mysterious disease prevalent among the natives, known as "Kakké". This word signifies 'leg-affection' being derived from the old Japanese word kiaku, leg, and ki or ke, spirit or affection. The disease has long prevailed in Japan, being described by a native physician as early as the year 1562.

The recent literature of the disease as it has attracted the attention of foreign physicians resident in Japan is as follows:-

A paper by Dr. Hoffman of the Imperial Medical School in Tokio, published in Transactions of the Deutsche Gesellschaft für Natur- und Volkerkunde Ostasiens in July 1873, never completed.

An article in St. Thomas's Hospital Reports Vol VII. new series, by W. Anderson M.D., Professor of Medical Sciences in the Naval College, Tokio.

Lectures on Kakké by the same author published in Yokohama, 1879.

Klinische Untersuchungen über die Japanische Varietät der Beri-beri Krankheit, Von Dr. A. Wernich, published in 1877 in

the 71st. volume of Virchow's Archiv für pathologische Anatomie und Physiologie

An article on Beriberi or the Kakké of Japan by Duane B. Simmons, M. D., in the Medical Reports of the Imperial Maritime Customs of China, 19th. Issue, 1880

Two papers with the same title in the Pacific Medical and Surgical Journal for Dec. 1880 and Jan. 1881 by Stuart Eldridge, M. D., Surgeon to the General Hospital, Yokohama.

Die Japanische Kakké (Beriberi) by B. Scheube in the Deutsches Archiv f. Klin. Med. Leipzig, 1882. XXXI.

All of these I have consulted except the last. All of these writers regard the disease as identical with or allied to the disease known as Beri-beri. The literature of Beriberi, however, reveals such conflicting and confusing opinions, that I deem it better to consider Kakké by itself and then consider its relations to Beriberi. In doing so I shall first give my own experience and supplement it by the observations of others.

At the commencement of my residence none of the above mentioned sources of information were available & the

and I had to study the disease as it presented itself to me. Many cases presented themselves under the name of Kakke which were simply synovitis of the knee-joint or oedema of the legs depending upon cardiac or renal lesions or anaemia. Hence I became sceptical whether any specific disease corresponding to the name Kakké actually existed. But I soon became aware of a large number of patients, who came to me with symptoms of defective innervation of the legs. They complained of numbness in the lower extremities, which they generally described as a feeling as if a piece of thin paper were spread over the skin, of slight loss of power in the legs showing itself by inability to walk any distance without inordinate fatigue, a tendency to stumble, and for the knees to give way. They experienced a difficulty especially in going upstairs, and sometimes in holding the thong of the wooden clog usually worn by the Japanese which passes between the great toe and the next. Some patients dropped the point of the foot in walking, showing a paralysis or paresis of the flexors of the foot and extensors of the toes. When the foot was planted evenly on the floor, they had little or no power to raise the toes from the ground, or if they could raise

the toes, little force was required to press them down. They had also a trace of oedema over the tibiae or about the ankles. In many cases there was tenderness of the muscles of the calf, which were in some instances hard and swollen, in other cases abnormally flabby and apparently partially atrophied. In almost all of these patients there was an absence or marked diminution of tendon reflex at the knee. Beyond the above symptoms they seemed to be in average good health. Some of them complained of vague dull pains in the legs. As illustrations of the above, I transcribe my note of the condition of some of them as they came to the dispensary. Kajiya Kumazo, male, aet. 20. Aug. 30. 1882. complains since 20th inst. of knees giving way while walking, and numbness pain above ankles & little above knees except at outer surface of legs, has no strength in his toes, he says, to grasp the clogs,— walks without bending the knee because if he does so much he falls, has absolutely no other sign of ill health. (P.S. Tendon reflex in this case was probably not examined.)

Ike Genkichi, male, aet. 28. Sep. 19. Kakke; since end of last month — especially bad last 10 days — walks with difficulty, can scarcely

rise pon sitting position, - pains in legs pon loins downwards, numbness pon knees downwards, no fever, no heart symptoms, appetite diminished, tongue foul, bowels rather confined. Ten days ago had a little gonorrhoea & still has pain on micturition, urine slightly turbid pon urethral and bladder - mucus - otherwise normal - attributes his disease to anxiety.

Ninjabera Fukumatsu, male, aet. 21. Feb. 4th. Complains of difficulty in raising toes of left foot, walks with toes drooping & turned outwards - slight trace of oedema over tibiae, numbness in calf and feet - has feeling of heat in left foot, and says that it feels cold on being warmed by the fire - no tenderness, began to complain early in Jan. - has scabies.

Furuta Naoji male aet. 21, Kabeke, Dec. 18. slight oedema over tibiae with hardness of muscles of calf of both legs, & feeling of contraction in them, some numbness, no pain, ill since middle of October, at first was unable to rise to the standing posture without help & had great difficulty in walking, now is able to walk 10 miles.

Such cases with slight variations might be multiplied, in which the symptoms were slight and confined to the lower extremities, which do not admit of classification with any

known disease, and can only be called defective innervation of the lower extremities. Occasionally however they assume a more serious form, for example; — Nishikawa Sokichi, aet. 25, male, Aug. 10th. complains of pain and swelling in calves of legs, since over exertion at a fire on the 6th. inst., with sense of contraction in the gastrocnemii and ham-string muscles. The pain is only on walking. The gastrocnemii are hard, tense, enlarged, not tender to pressure; no rise of temperature, but says he was feverish at first, general health good, was ordered rest and Linim. Sap. c. Opio. Aug. 16th. slight improvement but has also slight oedema over tibiae, and complains of tenderness in abdomen. Sep. 2nd. has had his legs bandaged, which seems to have had a good effect, but within the last 3 days complains of a feeling of constriction in chest, his heart's action is exaggerated and rapid - no murmur; has been living in a swampy situation, ordered to move away to the hills.

Such cases as the above, ill-defined and unsatisfactory as they are, form the first link in a chain or series of cases, which will become more distinctive and grave as we proceed. The last mentioned appeared to be one of inflammation of the muscles from

over-fatigue, yet developing the symptoms of more pronounced Kakke, with the heart-complications which sometimes suddenly assume so serious a form in that disease. It is this class of apparently trivial cases to which Wernich gives the name of 'abortive Kakke'.

In the majority of cases the symptoms are not confined to the lower extremities. Numbness occurs in other parts, most frequently in the finger-tips, the hands & forearms, and this is accompanied by some loss of motor power in the hands. The slight degree of anaesthesia may also occur in the abdomen or face. Oedema may also appear in the face. Palpitation of the heart occurs upon slight exertion, or palpitation of the abdominal aorta, and there may be the appearance of serious illness with pallor, or the patient may appear in normal health.

As illustrations of such cases, I take from my note-book the following cases.

Utashiro Kozo, male, aet. 35. seen on April 6th. 1882, states that he had Kakké 4 years ago, so severely that he was unable to move in bed, being paralysed in arms and legs. His illness lasted 100 days; he has never quite regained his strength, has numbness of the legs, cannot walk more than 2 miles, his knees ache when he sits on the floor,

has very slight oedema over tibiae. His hands are normal. He suffers from palpitation on exertion, but there are no other signs of derangement of the heart. He complains of a feeling of heaviness in the head, and that his eyesight is failing since January last; says that his sight became bad in June of last year, and in about two months improved again spontaneously. On ophthalmoscopic examination he has posterior staphyloma and signs of previous choroiditis. Concave lenses do not improve vision.

Takeda Saburo, aet. 21, a strong healthy looking lad, has slight oedema of legs, and complains of palpitation in abdomen. Excessive palpitation of abdominal aorta can be felt. He had Kakké last year for the first time, and then found it difficult to walk upstairs and had slight oedema, but otherwise was well. The oedema has never quite disappeared. He has no albuminuria, heart-disease or other symptoms.

Toyama Tatewkichi, aet. 18, male, complains of pain in the ankles, and gastrocnemii, numbness of toes, and palpitation on slight exertion. He has a downcast expression, but otherwise looks well. The tongue is flabby; he complains of a sense of obstruction in the stomach after food. The heart-sounds and

and pulse are good. He is an overworked apprentice.

Hanaye Kuma, aet. 15, seen April 8th. ill since December last, complains of pains in feet, tenderness over tibiae, numbness of toes, palpitation of heart on slight exercise, occasional swelling of face; has a feeling of difficulty in respiration. The first sound of the heart is a little muffled, the action of the heart slightly irregular. Appetite good, bowels open, urine normal. Otherwise well.

Yoshida Zeitaro, male, aet. 16, has had oedema of legs and face for 30 days past, with numbness of hands and feet for 10 days, has violent palpitation of the heart for the last two days, no murmur; heart's action rapid, but regular and pulse good, no albuminuria, is apparently of sound healthy constitution, has been a tailor's apprentice for two or three years, sits on floor of a low, damp room.

Tsunaki Toshita, aet. 18, a strong healthy lad, complains for a month past of numbness of arms and legs, with a trace of oedema of legs, and complains of a feeling of lassitude; otherwise no signs of disease.

Sato Kinkei, aet. 25, had Kakke last year; twenty days ago began to experience numb-

ness in knees which spread down to the toes, and for the last four or five days has had numbness in finger-tips, has pains in knees; ankles are stiff; no oedema, no fever; tongue foul, and has a feeling of distension about stomach, but appetite good, bowels regular; general health fair.

Heiyama Yoshisuro, aet. 21; has had symptoms of Kakké for the first time for the last 5 or 6 days, has numbness of legs from the middle of the thighs to the toes, and of the extremities of the fingers, pain in walking or on changing position, felt in the hamstring muscles and in the calf, also a feeling of twitching or contraction in the hamstrings which is worse on rising from the sitting posture; there is no oedema, nor tenderness of the muscles. The patient is anaemic, and looks seriously ill; had a sore on the penis six months ago, followed by suppurating bubo and no constitutional symptoms.

I regret that in the above cases the condition of the tendon-reflex was not examined, but during the last year I have been careful to examine and note it in all similar cases and have found it almost invariably absent.

Nimura Schichizo, aet. 43, a seller of vegetables, who carries about 165 lbs. weight of goods suspended from the ends of a pole laid

across his shoulder; he suffered from Rakke first 14 years ago, and had it 4 years in succession; at one time he was so ill that he could not stand; another year the muscles of the leg were so painful and hard that he could only crawl, and his legs were oedematous. Seen on Aug. 3rd. 1883, he complains of numbness of the legs, and of the skin of the abdomen, loss of muscular strength and loss of appetite. His symptoms commenced a month ago and he has been obliged to desist from work since the 13th. ult. He is a strong muscular man, but has a look of exhaustion. His legs are stout, but the muscles of the calf feel softer than normal; there is no tenderness on pressure. He can scarcely walk for ten minutes, and finds it very difficult to go upstairs. The numbness is chiefly on the inner side of the thighs, he is sensitive to pain and distinguishes two points fairly well, but feels as if a sheet of paper were interposed between the skin and the object touched; there is an entire absence of tendon reflex at the knee, but pricking the legs causes an involuntary start. He walks slowly and heavily. No oedema. The tongue is flabby and covered with white fur. Heart has a faint murmur audible at the apex

following the first sound, no palpitation or irregularity, otherwise well.

Fujita Seisaku 35 complains of numbness of back of leg, and at night pains on outer side of knee and inner side of thigh. From thighs downwards feels when touched as if covered with paper, especially at back of leg. Refex knee jerk absent, no tenderness. No numbness or other symptoms in upper extremities. Slightly deficient response of muscles of legs to faradic current, but becoming normal after short application. He is able to walk slowly 10 miles, but after walking the pains at night are increased. Has been in this condition on and off for three years; in other respects he is in normal health.

All the above cases are those of young men; children are never attacked, old men rarely, and women rarely except after childbirth. As an example of the latter I transcribe the following:-

Hirosawa Fune aet. 21 was delivered of her first child 25 days previously, after an eight-months pregnancy. The child lived only 2 hours. She is very pale and debilitated, and has a few papules and pustules on her face. Her voice is husky and feeble. According to the custom of the country she was kept

for seven days after child birth in a sitting position, that is, with her legs bent under her and the whole weight of the body pressing upon them. During this time her legs became numb and painful; this became worse after the 21st day, and she now complains, in addition, of a sense of stretching in the legs, and within the last few days her finger tips have become numb. There is not the slightest tendon reflex at the knee. The heart sounds are accentuated. Appetite and digestion good and in other respects she is in fair health.

Another case occurring in a woman is as follows:- Nozaki Tsuna, aet. 30, formerly a prostitute, now married, has had two children, both of whom died in infancy, one recently; she looks pale and weak, being exhausted by nursing her infant, and depressed by sorrow. She consulted me a few years previously for a painless abdominal tumour, which from its position and shape I took to be an enlargement of the pancreas, nature undetermined, and advised her to leave it alone. It has since gradually and spontaneously disappeared. She has no signs of syphilis. She now comes with slight oedema of the legs and face numbness of the legs, hands and abdom-

inal surface, entire absence of tendon reflex at knee, loss of appetite, nausea, excessive thirst, pain in abdomen on walking, relieved by pressure. Her symptoms commenced four days previously. No feverishness, no albuminuria, heart normal. She was ordered as a nervine tonic a mixture containing Zinci. Sulph. 2 gr. Liq. Strych. 3 m. Acid. Phos. dil 10 m. to each dose, to be taken 3 times in the day, and her limbs were to be daily faradized. After 23 days of this treatment her health is much improved in every way, but she still complains of numbness of toes, knees and tips of ring-fingers. She has now feeble tendon-reflex at knee.

Such are the cases of Kakke as they usually present themselves at out door patients at the Dispensary in Niigata. They are generally chronic, many of them state that they have previously suffered severely from the same disease. Their course is generally favourable. I usually prescribe a tonic such as that mentioned above, and have their limbs faradized. The disease however is not always favourable in its course, but the acute form of it, or acute exacerbations of it are very rare in my experience in

Niigata. I have seen three fatal cases and of these, I regret, that I have no notes. One of them was a domestic servant, a man about 35 years of age, whose symptoms were at first similar to those above narrated, with the addition that his voice-muscles were now the first affected. After a few days he became unable to stand, and crawled into the room on hands and knees. He went on now bad to worse, and losing faith in the foreigner, he came under the treatment of a Japanese physician, who was supposed to understand better the diseases of his own nation. He lingered for a few weeks, became emaciated, never lost entirely the power of motion in his legs, nor became generally dropsical, but died apparently by failure of the heart.

A second case was a man of middle age, admitted into the hospital with Kakké of sudden onset and severe type. He came into the hospital with the usual symptoms, scarcely able to walk, supported on both sides, distressed breathing, cardiac disturbance, and very anxious facial expression. I was called into the country and was obliged to leave my patient in the care of the native assistant, who

informed me upon my return that he had been seized with convulsions* and died in my absence.

A third was a similar case to the above, brought as an out-patient, but he declined to stay in the hospital and was taken home by his friends, doubtless to die.

At the risk of being tedious I have narrated cases with the view of giving a more truthful picture of the disease as it has occurred in that part of Japan where my lot was cast. The acute cases occur more frequently in other parts of the country and are thus described by Anderson. "In the acute form the grave symptoms may appear without warning, nearly always developing in the course of a sub-acute or chronic attack. A patient comes under treatment for Kakké of apparently an ordinary character; he is usually ~~well~~ strong and well-nourished, has no sign of anaemia and little or no oedema; the disease progresses in the usual manner and no evil is anticipated, when suddenly, rapid action of the heart, strong pulsation in the neck and difficulty of breathing appear, with a distressing pain in the abdomen- soon afterwards the patient vomits, and while an observer unaccustomed to see the disease still apprehends no danger, the

* The true character of the convulsions is doubtful.

Japanese doctor recognizes the commencement of "Shiyō-shin" and predicts that the man 'will surely die'. During the next few hours the breathing becomes more embarrassed, the pulsations of the heart more and more accelerated, and vomiting occurs from time to time. The patient now can lie down no longer; he sits up in bed or tosses restlessly from one position to another; and with wrinkled brows, staring anxious eyes, dusky skin and blue parted lips, dilated nostils, throbbing neck and labouring chest, presents a picture of the most terrible distress that the worst of diseases can inflict. There is no intermission even for a moment, and unless active treatment be at once resorted to, the pulse fails, the temperature sinks, and at length the brain paralyzed by the carbonized blood, becomes insensible, leaving the dying man to pass his last moments in merciful unconsciousness.

All acute cases, however, are not as terrible as this. Frequently a difficulty of breathing with cardiac disturbance may exist for one, two or three days without much change, and if these signs be, at their commencement, used as a warning the progress of the condition may be arrest-

ed almost with certainty, and even in the most desperate cases the physicians is not helpless" The word Shinyōshin above mentioned is a term applied to embarrassment of circulation and ~~suberspiration~~ respiration to a marked degree in Kakké.

A somewhat different clinical picture of the disease in its graver form is drawn by Dr. Simmons. He accepts without qualification the identity of Kakké with Beriberi. He makes a sharp distinction between two forms of the disease – the 'wet' or hydropic and the 'dry' or atrophic variety, following in this respect the distinction made by some writers on the disease in India. The 'wet' form he also calls 'pernicious' the prognosis being bad. Its distinctive feature is general anasarca. He says "In these cases, the anasarca which, as has been stated, constitutes the leading clinical difference between the two forms of the malady, plays an important rôle. It often happens that, in the course of a few hours, the local oedema in the extremities and the slight puffiness of the face become extreme, and the areolar tissue of the whole body is gorged with fluid. The cavities, especially the pleural and pericardial, suffer more or less distension with serum,

thus mechanically embarrassing the action of the organs they contain. The action of the heart becomes laboured, the lungs oedematous and filled with coarse râles. A terrible sense of suffocation comes over the patient, causing him to seek relief by constant changes of position. The stomach becomes irritable, and vomiting of greenish-yellow fluid occurs, this being almost always prognostic of a speedily fatal termination. The acute stage in the dry form is characterized, on the contrary by a rapid diminution of the fluids of the body, and an increase in the existing paralysis and muscular atrophy."

I have never met with a case of Kakke with general anasarca, or even an extreme degree of local oedema, and therefore do not feel competent to criticise Dr. Simmons description of it, but it seems to me that, as some degree of localized oedema is an almost constant symptom, probably invariably present at some stage of the disease, the occasional extension or exaggeration of it, scarcely constitutes a separate form of the disease. He emphasizes however, other points of distinction between the two forms;- "In the

wet form the pulse is full, large and easily compressible, showing a great ~~want~~ diminution of arterial tone; while in the dry form there is an exactly opposite condition. In the wet form, systolic murmurs are heard over the pulmonary valves, and over the large arterial trunks. In the dry form, murmurs are either slight or wanting altogether. In the wet form, the heart gives evidence of varying degrees of dilatation and want of tone, such as increased area of dulness on percussion, intercostal pulsation &c. In the dry form the area of cardiac dulness is variable. In the wet there is sluggishness of the bowels and urine is scanty, in the opposite form there is but little deviation from the normal."

I here transcribe from Simmons a report of a case of pernicious Beriberia, as he calls it.

S. aet. 26; policeman. Parents not living; father died from some chronic disease, mother from dropsy. Has three brothers and one sister living. Has never had syphilis or rheumatism, and his general health up to the present time has always been good. Entered the hospital 15th. June, with the

following history:—

During the first days of May, began to feel unwell, had occasional slight chills, followed by heat flashes, a general sense of malaise, and a tired feeling in legs. By degrees there appeared much in the following order, symmetrical anaesthesia of the skin over the tibio-fibular space in both legs, gradually extending up the anterior surface of the thighs to the lower part of the abdomen, then to the tips of the fingers, the dorsal surfaces of the forearms, and around the mouth; oedema of the anterior portion of the legs between the knee and ankle; a sense of fulness, attended by occasional spasms or constrictions of the muscles of the calves, slight pain in the knees and weakness, which with dropping of the feet and toes, caused him to stumble. Any considerable exertion brought on painful palpitation and praecordial oppression. Bowels sluggish; urine scanty.

Present condition.— He was above the medium Japanese stature, stout, but not corpulent, muscles firm and well developed. There was slight puffiness of the face, with characteristic sallow colour of the skin. The palpebral conjunctivae were of normal hue, though the vessels

appeared somewhat enlarged; tongue and mucous membrane of the mouth presented the same general appearance. Appetite fair, but had increased praecordial oppression after a full meal or the ingestion of liquids. The urine was of a brownish colour; no albumen; a very dark brown shade was given on the addition of an excess of nitric acid, becoming almost black on boiling. Inspection of the chest showed distinct vibration of the intercostal spaces over a large portion of the cardiac area, and palpation strongly impressed one with the violent struggling action of the organ. Apex impulse below and to the left of the nipple; first sound entirely masked by a loud blowing murmur, most distinct in the third intercostal space on the left side, though audible at the apex; second sound normal; carotid and abdominal pulsation very marked. The blowing murmur audible over the heart was common to all the larger arterial trunks. Percussion showed decided enlargement of the cardiac dulness; pulse 109, full and strong, the vessel feeling double its normal size. Cardiac oppression severe and increased by slight pressure on the epigastrium and walls of the

chest. Firm pressure on the spinous processes of the upper dorsal and lower cervical vertebrae decidedly painful. Muscular sensibility very pronounced, especially in the gastrocnemii and pectoral groups; later, this was observed in the masseters and the muscles of the anterior portion of the forearms and inner sides of the thighs. The oedema of the anterior tibial regions had now become more or less general, a condition probably existing from the first, but less easily demonstrable. 17th. June.— Pulse 104. Feels somewhat better, a saline purgative having been administered early in the morning.
18th. June.— Pulse 98. Feels worse, and complains very much of the violent action of the heart, even while at complete rest. A sudden fall of the temperature had occurred with rain within the last 24 hours. 20th. June.— Pulse 90. Is somewhat less oppressed in consequence of active purgation and draining away of fluids, but he is weaker. 21st. June.— Pulse 89. Heart's action still violent. Vomited about 12 oz. of greenish-yellow fluid, which appeared to give temporary relief.
24th. June.— No material change since last note; gradual loss of strength; increasing

anasarca, especially of the face; skin becoming of a leaden hue. 25th. June.— Pulse 110. Vomited several times today, and is rapidly sinking. Is very restless; constant by changing his position in vain attempts to obtain relief from the sense of impending suffocation. Crepitant râles appeared in both lungs. The pulse rose to 120, and then disappeared at the wrist; the extremities became cold, and at 12 M. he died rather suddenly."

An autopsy was obtained in this case which will be given later.

This completes the clinical account of the disease, but the symptoms must be considered more in detail. The most prominent and important are those which are referable to the nervous system.

Anaesthesia of the skin is almost invariably present, is never complete, and is always localized. It always commences in the lower extremities, where it also persists longest, tends to spread upwards to thighs and abdomen, often suddenly appears in finger-tips or hands, or around the mouth, and, in other situations than the legs, is fugitive in character. I have found attempts to measure the degree of anaesthesia un-

satisfactory. Dr. Wernicke has however elaborately tested the sensibility of the skin. (Bernstein) I tried to elucidate the specific sensory disturbances by clinical researches to the best of my ability. Indeed there has been hardly one case in which I have not tried all the tests for the most common varieties of sensation. The results are as follows. Analgesia in 25 per cent. A prick or scratch or strong faradic ~~coarse~~ touches were felt only as touches. At the same time, half of these patients felt pain if along with the skin, the subjacent structure was pinched. Sense of locality according to Weber's method with a pair of compasses was in most cases not sensibly diminished. During the course of prolonged examinations patients sometimes stated differences in the size of a circle, but these were less intelligent patients whose attention soon failed. A diminution in the sense of pressure was noticed only in eight patients or about 6 per cent of the cases. All these had had the disease already several times and stated, on being questioned, that never after had they recovered acute sensibility in their legs. All the other patients distinguished weights from 60 to 70 grms. and upwards with

normal precision. The sense of temperature was nearly always affected, namely, in 82 per cent and this already in the earlier stages. With peculiar accurateness the patients were able to feel the percussion hammer or any other cold object as being much colder at the normal portions of skin than where they were anaesthetic to touch. Also hot objects were distinguished with much more exactness at normal portions of skin, whilst in the anaesthetic regions when the temperature was raised above 45° or 46° C. indistinct sensations of pain were felt, caused by the contact of the hot object." Anderson observes "The degree of impairment of tactile sensibility is found by the aesthesiometer to vary from 25 to 75 per cent of the normal acuteness." It has seemed to me that the subjective numbness of complained of by Raikè patients was in excess of the objective, that is, that the diffused sense of alteration in cutaneous sensibility was greater than could be demonstrated by endeavours to test it. It is important to note that the anaesthesia is symmetrical in character.

The special senses are not affected. Wernich however remarks "They say that taste is somewhat diminished, even when the

stomach is not affected". There is no hyperaesthesia at any stage of the disease, except the tenderness of the muscles.

Loss of motor power. This too is a constant symptom also commencing in the lower extremities and chiefly confined to them, never becoming absolute. Most frequently the gastrocnemii and the quadriceps femoris are affected. The paresis of the rectus femoris is shewn by a tendency to fall forwards on the knees when bent, a sense of looseness in the knee-joint, and a feeling of concussion on the condyles when walking, due, no doubt to the deficient tone of the muscles which fail to keep the articular surfaces well together. Sometimes it is especially the muscles which flex the foot which are weakened and then the peculiar gait is observed in which the patient lifts the feet high to avoid dragging the toes along the ground, or to relieve the weakened muscles, the work being thrown upon the flexors of the knee. It is this probably which has led to the name beri-beri in India, if, at least, the suggested derivation be correct, viz.— from the Hindi word, Bhéree - a sheep, from the fancied resemblance of the gait of persons affected to that of sheep.

This loss of motor energy, like the anaesthesia also appears in a less degree and less frequently in the upper extremities, and perhaps often escapes notice. A curious fact analogous to that of the anaesthesia appearing about the mouth, is that the vocal muscles are sometimes affected, and I have noted one case in which the muscles concerned in articulation were interfered with, the patient complaining that the distinct enunciation of his words required effort. The sphincters are never affected. The degree of muscular weakness varies. In the lowest degree it is inability to walk more than a short distance from a sense of fatigue, which may become aching in the muscles; then the patient may be unable to ~~crawl~~ walk but can crawl. He may have only the power of moving the limbs as he lies in bed. When the disease has lasted long, the muscles atrophy and the paralysis becomes complete. Anderson found that the average loss of strength when the patient comes under treatment is about 60 per cent as tested by the dynamometer. That this symptom is not due to mere malnutrition of the muscles is evident from the fact of its occurrence

in well-nourished patients. It is, besides, localized to certain groups of muscles, and is symmetrical.

As to the condition of the muscles, in some cases the muscles of the calf are tense, swollen and tender as if they were the seat of inflammation. This condition subsides and leaves them flaccid and softer than natural, though the tenderness may remain. In other cases the muscles seem to become soft and tender and undergo more or less of atrophy from the first. This is generally completely recovered from, but Anderson mentions some cases in which a permanent atrophy of a certain group of muscles remains.

As an illustration of a case in which muscular atrophy was the most marked symptom I quote the following from Simmons.

"Beriberia Atrophia.- Mrs. M. aet. 33 years, wife of an official of the better class; resides in an elevated, well drained locality on the side of the bluff facing the town. Was confined with her second child on the 1st. July, 1873. During the last months of pregnancy had experienced a sense of weight in the lower extremities, and shortness of breath on exertion, more marked than while carrying her other child. Delivery was normal,

child well-formed and apparently healthy, but it died in three days from causes unknown; the mother's milk disappearing without trouble. During the subsequent ten or twelve days, she frequently complained of constriction of the calves of the legs, and more or less pain on pressure or forced movement in the muscles of the anterior part of the fore-arm. Occasional feelings of oppression in the præcordia, and slight palpitation were also noted. On attempting to stand at the end of the twelve days mentioned, she found herself quite unable to do so. Her condition from this time became steadily worse; she suffered little when quiet, but muscular movement produced pain. On the 1st. September, two months after confinement, she was admitted to the hospital, completely helpless, not being able to extend or flex a limb, or move from side to side unaided. The muscles of the extremities were extremely atrophied, the anterior tibial muscles were paralysed, while those of the calves were much contracted, bringing the foot into a complete talipes position; the dorsal muscles of the fore-arm were paralysed, and the palmar contracted, bringing the fingers tightly into the hand. Any attempt

made to rectify these abnormal positions was productive of great pain. The pulse was small; the heart apparently contracted and acting feebly, and there was present the metallic systolic ring of chronic cases. Tongue clean, appetite fairly good, bowels slightly constipated, urine normal in quantity and quality. She complained of nothing but some constriction of the chest, and palpitation, these varying in degree with atmospheric changes. At this time I took with the harpoon, several specimens from the muscles of the calf and from the tibialis anticus for microscopic examination. These showed extreme degeneration of the muscular elements. A variety of means were with but little success resorted to for her relief, including electricity, strychnia, iron, friction, and so on. At the end of two months she was transferred to an invalid resort in the mountains, the result being most satisfactory — a change immediately taking place for the better. Four months later on she again entered the hospital being now able to raise herself to a sitting posture and change her position in bed, while the rigid contracted condition of the muscles had partially disappeared, one finger only, the little one, remaining tightly

flexed. The former extreme atrophy of the muscles had been followed by a considerable increase of their bulk. Specimens again taken with the harpoon demonstrated a partial restoration of the primitive muscular element. After remaining a month longer in the hospital, she returned home. ~~After remaining~~ &c. Improvement continued during the following summer and winter months, until she could be up and walk about.

In the meantime she again became pregnant, and in June 1874 was delivered of a healthy child. With this event the old symptoms returned. Paralysis and atrophy of the partially restored muscles of the limbs followed, and at the ~~the~~ end of ten weeks she again entered the hospital. Her condition was not so bad as on the first occasion, as she could turn over in bed unaided and to some extent move the limbs. The heart symptoms were the same. Remembering the benefit gained by her sojourn in the mountains, she again spent several months there, with the same decided benefit. Early in the spring she returned home, and, to my surprise, could walk with comparative ease, though unable to quite bring the heel to the ground, in consequence of some remaining contraction

of the muscles of the calves. The whole body, including the extremities, was plump and well-rounded, and she appeared as well as before her first attack. During the following summer she again became pregnant, and her confinement was followed by a third relapse, but in a much milder degree. From this she readily recovered, going at once to the mountains, and remaining until well."

It is necessary to add that the above is an exceptionally extreme case of muscular atrophy, and it is highly probable that, though oedema and anaesthesia of the skin are not mentioned in the report, they occurred at an early stage of the disease, before admission into hospital and were not noted by the patient.

I regret that I have not exact observations to offer with regard to the electrical reactions of the muscles. I never applied electricity to them in their tense condition; in their flaccid condition there seemed to be a diminution of their excitability by the faradic current. Anderson remarks "In the ordinary form the sensibility of the muscles to Faradism and Galvanism remain unimpaired, indicating the central origin of the paralysis", and in cases of marked atrophy he says "as atrophy progresses

the electrical reactions become enfeebled."
Simmons remarks "In all the electrical experiments made on the voluntary muscles the degree of excitability was in the inverse ratio to the pathological changes they had undergone."
Wernich observes "Electric excitability of the muscles is in direct (he probably means 'inverse') relation to atrophy of muscles, but it must be stated that there is a brief period when the excitability is increased. This comes on with diminution of the extensive anasarca. If a short time previously strong faradic current show it much diminished, one is apt to rejoice at finding reaction developed again as the oedema goes, but the atrophy is by no means at an end with the oedema, on the contrary it sometimes seems then first to come on in full force - probably because in the spinal canal and nerve-roots resorptive or other processes may come into play, entirely different from those in the subcutaneous connective tissue. Hence from day to day excitability diminishes and atrophy goes on."

Patients often complain of twitchings or contractions of the muscles, but I have never seen anything deserving to be called "cramp". I suppose them to be either subjective or fibrillar. There are no tremors

or choreic movements. Superficial reflexes appear to be diminished in proportion to the anæsthesia. Tendon reflex at knee, in those cases in which I have examined it, is almost invariably wanting. There is no impairment of coordination. Cases of locomotor ataxy occur of same type and about the same frequency in Japan as in Europe, but I have never seen any connection between it and Kakké. There is no pain referable to the spine, nor have I found tenderness on percussion over the vertebrae. Well-marked girdle-sensations do not occur but patients occasionally mention a sense of constriction when asked. There are no cerebral symptoms, on the contrary I have always found the mind perfectly clear. Wernich mentions a degree of mental dulness. There are no signs of inflammation of nerve-trunks. Bedsores, I believe, never occur. The functions of the bladder and rectum are never interfered with. Wernich mentions that in cases of extreme anasarca, after it has disappeared the skin gets dry like parchment and loses its downy hairs.

Next in order of frequency and importance are the symptoms of disturbance

of the circulation. We shall consider first the blood itself. This has not in my experience presented anything characteristic. There is almost unanimity among observers of the disease in Japan, that anaemia is not an essential nor important element in the disease, and this is in remarkable contrast with the views of writers on the disease in India, who hold that it is due to hydraemia and a scorbutic taint, and is a disease of debility. According to Anderson "In the cases occurring in the Japanese navy not more than 5 per cent show signs of anaemia, and even when the complication is present, it bears no relation to the severity of the special symptoms." Eldridge says "Anaemia, properly so called, rarely exists in Beriberi, save as an accidental complication." Simmons suggests that anaemia when present is rather the result than the cause of the disease, and remarks that treatment directed to anaemia is wasting precious time and has often a disastrous result. Dr. Wernich has however propounded the theory that the disease is essentially a decomposition of the blood - "Blut-decomposition" and bases this in part upon his microscopic examination of the blood. He admits that

"the red corpuscles appeared not to be different as regards their number and form from those of normal blood at least during the incipient stage and in less severe cases." In "whereas in more advanced cases the size of a single corpuscle was markedly less than the normal. Besides, the corpuscles in these cases exhibited a distinct strawberry-like or 'morning-star' form, with little projections or points and never assumed the form of rouleaux." He remarks that the blood had a "less vivid colour", but was not particularly watery. Under the microscope the white corpuscles were not altered nor increased in number "but here and there scattered between them ~~were~~ finely granular, pale yellow, dimly shining masses were visible, the circumference of which exceeded in magnitude the size of a white corpuscle." A wider observation shows that there is nothing characteristic in all this. In reply, it is sufficient to quote from Gulliver in his Lectures on the Blood. After pointing out what a sensitive oidiometer the corpuscle is, he says "You may ~~have~~ see the corpuscles quite flat, rather turnid, like a circular or oval cup, stellate, notched, granular, crescentic, angular, lanceolate, comma-shaped,

sigmoidal, fusiform besides other varieties defying definition. Hence one is often seriously informed how some person has discovered that they are either mulberry-shaped, star-like, indented like a cog-wheel and so forth; and the authors of such observations are not always satisfied when told that the regular corpuscles may and do change their shape by puckering, shrinking or becoming corrugated into such figures, or swelling out into others, while some like forms may be produced merely by the action of saline solutions of certain specific gravity according to the effect desired." I have myself observed a similar condition of the blood in patients who had no symptoms of Kakké.

Cardiac symptoms are absent or trifling in the more chronic and mild form of the disease. Palpitation and visible pulsation are the most common symptoms, occuring either on slight exertion, or, in worse cases, spontaneously. Palpitation occured, Anderson says, in 60 per cent of his cases, Eldridge says almost invariably. He says "the heart impulse is widely distributed, abnormal sounds are heard suggesting valvular derangement, while both palpation and auscultation detect at the cardiac base

and for some little distance above that point a peculiar semi-metallic purring thrill, wh. when clearly distinguished is of itself sufficient to establish a strong presumption as to diagnosis. I have never found in the disease as it presents itself on the West Coast any pathognomonic sign in connection with the heart, the more severe forms of it rarely occurring, and where heart-complications exist, the other symptoms of the disease are already well-marked. Besides the palpitation, irregularity to a slight extent, and rapidity, sometime, an indistinct character of the sounds at the base, sometimes an accentuation, sometimes a faint murmur I have noted, but never any sufficient evidence of organic change. In the more serious forms of the disease well-marked murmurs, degeneration of the muscular fibre of the heart and dilatation of the organ appear to take place.

The condition of the arteries indicates disturbance of the vaso-motor centre. Throbbing of the vessels of the neck is a not infrequent sign in acute cases, and is of ill omen. I have noticed excessive throbbing of the abdominal aorta. In the cases which have come under my notice the pulse when it has perceptibly departed from the normal has been

soft and weak. Dr. Wernich has made laborious & careful observations with the sphygmograph. In his tracings taken in typical cases of Kakke the upstroke is vertical and high, indicating free and sudden ventricle-contraction, the apex is acute, the line of descent is more rapid than normal, neither the tidal nor dicrotic wave are well marked; in many of them there is only one wave representing feebly the aortic notch and wave, so far resembling, as he says, cases of aortic incompetence, not due however to that cause, but probably due to or explicable by deficiency of reacting power in the arterial walls. As he observes, "in more severe cases the pulse-curve assumes the form which ~~xxxxxx~~ suggests a great flabbiness and deficient elasticity of the arterial walls."

To be considered with the other disturbances of circulation is the <u>oedema</u>. This I believe to be a constant symptom of the disease. It is often transient and slight in degree and therefore easily overlooked. It is an early symptom and generally appears first in the subcutaneous tissue of the front of the leg, which pits slightly on pressure over the tibiae. The next most common situation is the face, not about

the eye-lids in particular, but giving a general roundness and fulness to the face which in young men gives them a girlish appearance. Like the anaesthesia and the muscular paresis, it is symmetrical. It occurs independently of cardiac, renal and anaemic complications. In some cases it assumes an alarming degree, becoming general anasarca, and coming on suddenly as oedema of the lungs, or serous effusion in the pleural cavities, may be rapidly fatal. These are such striking and important features in the disease that they have been made to constitute a separate variety of it, and Simmons states "As a symptom of beriberi dropsy is confined to the wet form of the disease." This I believe to be incorrect, and misleading in the consideration of the pathology of the disease.

Affections of the <u>respiratory</u> organs occur only in the later stages and grave forms of the disease. Laboured breathing amounting to orthopnoea may occur with palpitation of the heart and physical signs of oedema of the lungs or pleuritic effusion.

Derangements of the alimentary system are as a rule not present. I have never seen anything more serious than slight

catarrh of the stomach. The vomiting which occurs towards the end of fatal cases would appear to be of nervous origin. Anderson remarks that it is chiefly characterized by the absence of signs of common gastric irritation and by its constant association with shortness of breath, palpitation and other bad symptoms. "It is sometimes sympathetic, repeated at long intervals and seemingly without influence upon the course of the disease; in other instances frequent, very distressing, and associated with severe abdominal pain; and in a third set of cases, those with pulmonary oedema, apparently acting in aid of the violent efforts which the patient makes to relieve his choked air-passages of effused fluid."

Secretion of urine present nothing characteristic. It is diminished in quantity when dropsy is well-marked, otherwise normal. Albuminuria does not occur, except in rare instances as an accidental complication. The skin is generally dry. Wunsch remarks "Kakké patients perspire only in agony under excruciating palpitation or but very rarely after diaphoretics. They perspire one may say internally.

The epidermis feels cool and dry; at times, when as in July and August it came pouring down from our bodies and during examination of patients would not allow our hands to be quite free from it, their epidermis felt like thin Japanese paper. No scales came off, no desquamation, no blisters."

Reproductive organs are not specially affected. I have noted one chronic case in which the patient complained of diminution of sexual power. This probably usually occurs as a result of the general debility without any special affection of the organs or their nervous centre.

Temperature. All observers of the disease are agreed that it is non-febrile. I have once or twice noted a rise of temperature to a trifling degree at the commencement, and occasionally patients have complained of a slight chilliness before coming under treatment, but as a rule the temperature is normal or sub-normal.

In the naval Hospital Anderson found elevation of temperature in one per cent of the cases.

As to frequency the statistics of my own dispensary and Hospital would not be of

any value because in my practice eye-diseases and cases requiring surgical interference have preponderated in proportion to their frequency in the general population In a disease known to be peculiar to Japan many prefer to consult a physician belonging to their own nation. The naval and military hospitals can furnish reliable information. These together for the year 1875 quoted by Anderson give 3·8 admissions to hospital out of the total force, but, including slight cases not admitted to Hospital, the total proportion is 26 per cent. These figures refer to Tokio. In the military stations in the south of Japan the percentage of admissions is also 3·8, that of the whole number reported sick from this cause, 33 per cent. In one of these stations among 3,445 men 1,844 cases of the disease appeared during the year. In Sendai on the east coast, a similar ratio is reported." In the naval Hospital the cases of Kakke being classified as Sub-acute, Chronic and Acute their relative frequency is represented by the figures, 67, 16, and 17.

Mortality — The statistics of the Army department show the number of deaths in 402 cases treated in the Hospitals in

Yedo during 1875 to be 89 or 22.13 per cent. and 25 men, or 6.25 per cent. were discharged from the service as invalids. In the naval Hospital in 590 cases treated from 1874 to 1878 (inclusive) the death rate was 5.8 per cent., the highest rate being 8.6 per cent in 1875; the lowest, 5.2 per cent in 1877.

The Army returns for the whole of Japan in 1875, a fairly average year, show a mortality of 17.65 per cent. of the cases treated in the Hospitals (the more trifling cases being attended to elsewhere). The highest rate was 30 per cent. the lowest 13 per cent. (Anderson). Of the 216 cases admitted into the Police Hospital in Yokohama in 1871 (whole force 500) 11 only were fatal, about 5 per cent. (Simmons)

Morbid Anatomy — Although the number of victims of Kakke every year is large, owing to the extreme difficulty of obtaining permission to open the dead body in Japan, very few opportunities of ascertaining the morbid anatomy have occurred. I have been able to find only five records of autopsies, two by Simmons, and one by Anderson, and one each by Wernich and Eldridge, which I shall here give in extenso in that order.

The first case is that of S. aet. 26. policeman, whose history has already been given. Autopsy, 24 hours after death. — Rigor mortis wanting. Ecchymosed, purplish spots from the size of the finger-nail to that of the hand over the whole surface of the body. Tympanites inconsiderable. Subcutaneous areolar tissue gorged with serum. Intestines moderately distended with gas, colour bright pink, from capillary congestion, and very translucent, Peyer's and the solitary glands appearing from the outside with a distinctness rarely observed from within. Peritoneal cavity contained about ~~to~~ 12 oz. of clear fluid. Lungs oedematous. Left pleural cavity contained 13 oz. clear fluid, right 5½ oz. Pericardium contained 2 oz. of the same clear fluid. Right auricle contained

a large firm clot, filling a 2 oz. graduated glass; one half of its surface covered by a firm, white fibrinous substance one-eighth of an inch thick. Right ventricle contained an elongated hourglass-shaped clot, extending through the valve into the pulmonary artery, and in the first and second ramifications of the vessel were small emboli, appearing as if recently detached from the main clot. This was beyond question an antemortem clot as indicated by its extreme firmness and by the behaviour of the heart during life. A still further proof of this was the fact that a microscopic examination of the white fibrinous portion revealed a capillary network containing blood-corpuscles not only on its surface, but penetrating its substance. (I am aware that this is not only rare but regarded as impossible by some observers) The left side of the heart contained a small quantity of feebly coagulated blood only. The cardiac valves were all examined with care and showed no signs of disease. Weight of the organ when empty 14 3/4 oz. The ventricles were dilated, their walls attenuated, and the whole

structure wanting in that degree of firmness proper to the normal heart. Microscopic examination demonstrated the muscular substance to have undergone degenerative changes. Stomach contained 8 oz. of a greenish yellow fluid; its mucous membrane showing a number of dark red and purplish spots, giving it a mottled appearance. Spleen small and firm; weight, 5 oz. 6 dr. Liver presented no marked abnormal appearances; weight 5½ oz. Kidneys: weight 5 oz.; dark in colour; capsules free.

Case 2. was that of a young man with general anasarca, complaining of praecordial oppression, palpitation, weakness in the legs, and anaesthesia, pulse soft & full ranging from 90 to 100. temperature normal or a little below it. dyspnoea, coarse bronchial râles heard over whole chest, dulness on percussion at base of lungs, especially the right. A loud systolic murmur at the base of the heart. Following day pulse 110 and very feeble, intense dyspnoea, enormous oedema about the neck. The paralysis of lower extremities somewhat less than at earlier stage. Two days later, the symptoms becoming more intense, he expired, the mode of death being by

asphyxia and paralysis of the heart from over-distension.

Post mortem Examination, 24 hours after death:— Rigor mortis wanting; excessive general oedema, most marked, however, in the upper portion of the body. The recti presented a peculiar black-greenish colour throughout their whole breadth and length, while the muscular tissue in all other parts of the body preserved its normal pinkish colour. The external appearance of the intestines was somewhat peculiar, some portions showing a bright red arborescent injection, while others were mottled with greenish-grey spots. The peritoneal cavity contained 7½ oz. of clear serum. The mucous surfaces of the stomach and intestines exhibited marked signs of congestion throughout their whole length. Liver: serous and cut surfaces somewhat dark, but otherwise apparently normal; weight 56 oz. Kidneys: capsule free, gen'l appearance normal. Spleen: size and appearance normal. Right pleura adherent throughout its whole anterior and lower portion, the remaining portion contained 14 oz. of serous fluid. Left pleura entirely free, its cavity containing 2 oz. of clear serous fluid. Lungs: both exceed-

ingly oedematous, a pothy seo-sanguino-
lent fluid flowing from their cut surfaces,
quickly forming considerable pools on the
table. Heart: pericardium free, showing
no signs of inflammation new or old;
its cavity contained 1½ oz. of clear serum.
The organ was large and remarkably
flaccid, its tissue softened and of a dirty
yellow colour. The unusual size of the
heart appeared to be due to excentric
hypertrophy. The right side contained a
small amount of semi-fluid blood; left
side empty. Endocardium and valves
apparently normal. Microscopic examin-
ation of the muscular tissue of the organ
showed it to have undergone primary
degenerative changes, indicated by the
indistinctness of its striations, and in
many parts their entire obliteration by
fine granulations. All the large venous
trunks were enormously dilated and
filled with clotted blood (accounting for
the lateral swelling of the neck always
present in the last stages). The secondary
divisions of the venous system, as far
as could be traced, were also markedly
distended and engorged with blood.
Brain: a small amount only of sub-
arachnoid effusion of serum existed;

external appearance of the brain and its membranes otherwise apparently normal. The ventricles contained little or no fluid; cut surfaces of the brain substance firm and apparently normal. The spinal cord was removed with great care. Sub-arachnoid effusion of serum considerable. The nerve substance being exposed, and a stream of water gently poured over it, a partial disintegration and separation of its lumbar portion followed. Sections from the remainder of the cord, hardened in the usual manner, were subjected to a microscopic examination, and appeared perfectly normal.

Dr. Anderson's case is as follows:— The patient, a strong, healthy man, aet. 23, without a sign of anæmia, was admitted for sub-acute Kakké. A few days after coming under treatment he was suddenly attacked by dyspnœa and anxiety, with pain in the epigastric and hypochondriac regions, and vomiting. The dyspnœa and pain gradually increased in severity, causing terrible distress, and the vomiting recurred at frequent intervals, the ejecta, at first chiefly bilious, afterwards became pulty and blood-stained, and appeared to come in great part from the air-

passages. Examination of the thorax revealed signs of oedema of the lungs, but there was no evidence of pericardial effusion. The pulse slowly failed, becoming imperceptible at the extremities, while the carotids still throbbed visibly, the temperature sinking until, just before death, it reached 93°. Consciousness remained almost to the last. There was no purging. Death occurred at the end of twenty hours from the commencement of the acute symptoms. The post mortem examination was performed fifteen hours afterwards. The chief points revealed were as follows:— General aspect.— Body muscular and well nourished, rigor mortis well marked. Face dusky, lips blue, integument of trunk and lower extremities stained of a purplish colour, chiefly but not entirely in dependent positions. Lungs.— Bronchial tubes and air cells contained a large quantity of frothy fluid. Parenchyma doughy and oedematous. Larger vessels loaded with dark fluid blood. Pleurae normal. Circulatory organs.— Pericardium contained about 2oz. of clear fluid, and a flat, dark blood coagulum about two inches in diameter. Vessels strongly

congested. Heart.— muscular substance firm and healthy; valves normal. All cavities contained clots, that on the right side large, soft and dark, on the left side smaller, firmer and partly decolorized. Muscular fibre pre pour all trace of degeneration.

Digestive organs.— Stomach contained some pothy fluid and a little milk that had been swallowed shortly before death; large ecchymoses were seen in two situations beneath and in the substance of mucous membrane. On microscopical examination the surface was found to be completely denuded of epithelium, and the vessels of the muscular and submucous coat were gorged with blood.

Intestines.— Aspect highly congested; contents fluid and of a dirty yellow colour, but not in very large quantity. Submucous ecchymoses in two or three situations in the upper part of the small intestine. On microscopical examination the surface was found to have lost its epithelium except where inflected into the Lieberkuhnian tubes; the veins were extremely distended with blood; and the involuntary muscular fibres and Meissner's ganglia were unusually distinct.

Liver, spleen and pancreas congested.
Peritoneal cavity contained no effusion.
Nervous system.— Brain.— Membranes somewhat congested; no effusion beneath membranes or in ventricles. Brain substance normal in appearance and firm on section. On microscopical examination no changes were found in the nervous structures, but the capillary vessels were unusually distinct, though empty and were collapsed in a very irregular manner, as if after great over-distension.
Medulla oblongata and Cord.— Membranes congested; two blood extravasations of considerable extent were present on the outer surface of the dura mater in the cervical region. Condition on microscopical examination similar to that of brain. The proper nervous details were perfectly normal. The various sections were preserved for ordinary histological demonstrations. Nerve trunks of limbs normal. Solar plexuses and semilunar ganglia apparently healthy.
Urinary organs.— Kidneys somewhat congested.
Bladder contained a small quantity of urine which was pee pour albumen.
Blood dark and fluid in organs,

coagulated in terminations of venae cavae. No peculiarity seen on microscopical examination. Proportion of red and white corpuscles not abnormal.

Eldridge's case is thus reported:- The subject was a prisoner in the jail at Hakodate, and succumbed to the acute dropsical form of the disease, the immediate cause of death appearing to have been pericardial effusion. This was one of the first cases which came under my observation.

Anasarca, general save in dorsal and lumbar regions; muscles well developed and of good colour; skin much ecchymosed.

Cranium.- Meninges much congested, blood very fluid, a condition afterward found to prevail throughout. Slight effusion of yellow serum beneath membranes. Cerebral parenchyma oedematous, ventricles contain an abnormal amount of yellow serum.

Spinal cord and Canal.- Much deep yellow fluid through whole length of canal cord and its membranes apparently normal, save in lumbar region where the membranes were intensely congested and the cord itself enlarged and so softened as to make its removal a matter of difficulty.

Thorax.— Much deep yellow serum in both pleurae, no adhesions, left lung solidified by pressure, due both to the pleural effusion and to that in the pericardium, the latter containing some two quarts of the generally present yellow serum. Heart enlarged, dilated and hypertrophied, ante-mortem clot in left ventricle, right heart and venous system generally enormously distended with fluid blood, muscular tissue of heart soft.

Abdomen.— Some two or three quarts of yellow serum present. Liver enlarged to nearly double usual size, pale and marbled in section. Gall bladder, stomach, intestines, pancreas and kidneys apparently normal, spleen enlarged and softened.

Microscopic examination of the softened portion of the cord showed great distension of the capillaries with many small extravasations. The heart tissue was fatty, as was that of the liver.

(It is impossible to say to what circumstances, independent of the attack of Beriberi the disease of the liver may have been due, as I could obtain no history of the case antedating the final illness).

The following is the case in which Wernich obtained a post mortem examination

Hirakawa aet. 26 pow south of Japan. His father died after gastric disease, mother after seizure of apoplexy; strongly built, never ill previously. Has felt ill since the end of Jan. 1875, complained of unpleasant feelings in the epigastric region, oppression of chest, increased secretion of saliva and scorbutic troubles. In July to these symptoms were added great weariness in the lower extremities, palpitation after movement, bad appetite; the sense of oppression in the epigastric region became stronger and very troublesome. Since Aug. 12th all the symptoms became worse and frequently disturbed his sleep; vomiting occurred once or twice in the day. Aug. 19th. Patient very anaemic, complexion grey and cachectic, speech rendered difficult, dyspnoea always present, very frequent palpitations, skin everywhere thin and dry, muscles flabby face oedematous; several times every day vomiting occurs. Patient is very restless, when lying in bed; walking and standing possible only for a few moments with support. Both the lower extremities completely, the upper in less degree anaesthetic, bad appetite, diminished urinary secretion, 250 gr. – no albuminuria, defecation difficult. The movement of the heart cause trembling

or shaking of the whole anterior wall of the thorax to a considerable extent, although the hand when placed upon the apex notices only a slight beat, pulsations of the carotid arteries are considerable, even enormous, and are continued up into the posterior auricular arteries. Pulse, 96 per minute, wave high but easily compressed. Pulse of radial artery small, tension slight, every new pulse-wave is preceded by a slight wavelet, perhaps followed. The apex-beat lies somewhat away from the left mammary line. The cardiac area below is somewhat greater in the transverse diameter than normal, extends to the left about a centimetre beyond the mammary line. Cardiac dulness is distinct as far as 5 centimetres beyond the right border of the sternum. (Hence dilatation of right ventricle.) Heart sounds at apex altered .... Over the aorta a blowing murmur is heard which extends over both phases. Over the pulmonary artery same sound is heard but weaker .... During the following days dyspnoea and vomiting being continued, attacks of very violent praecordial pain occured which were relieved with difficulty with weak injections of morphia and sinapisms: twice or three times vomiting of yellowish material; the anaesthesia is now complete; more-

ments quite impossible; urinary secretion stopped. temperature 37.1°, pulse 104. Inspiration 32-36. Aug. 24th. Slight effusion in the pleurae on both sides, more marked on the left. Pulsations of the visible arteries considerably increased. Patient lies on left side. Toward evening consciousness remaining, but somewhat weakened, very slowly slight cyanosis of all the visible mucous membranes and at 9 p. m. death superveined, the inaudibility of the sounds of the heart and asphyxia ushering it in.

Dissection 14 hours after death. Very marked rigor mortis, especially of the upper extremities. On thorax traces of cupping and other depletions, and the face still distinctly cyanotic; the skin very dry, scarcely any adipose tissue, and flabby. Muscles pale and flabby, the thorax and abdomen soft, infiltrated with fluid, but no fatty degeneration. In the abdomen 200-240 grammes of amber-coloured transparent liquid. Diaphragm is normally placed. Both pleurae together contain about 500 grm. of amber coloured serous fluid. Pericardium contains 50 grm. of clear, yellow fluid. The parietal and visceral portions show in some places tendinous opacities and thickenings. The heart's apex is formed to

an equal extent by both ventricles, appears completely rounded. Muscular fibres of left ventricle are of normal thickness and texture, whereas the wall of the right ventricle measures only 5 millimetres in thickness, is somewhat pale and yellowish in transverse section. On microscopic examination distinct transverse striation is seen, but at some places there is granular & fatty degeneration, but never to such a degree as to render the muscular texture entirely invisible. In the left ventricle and right auricle great masses of slightly coagulated dark red blood. In the right a clot with pale surface, the mitral valve flaps are delicate, not abnormal. The aortic values normal. Tricuspid valves and pulmonary, likewise no alterations whatever. Left lung adherent nowhere, containing air everywhere, surface partly pinkish, partly slate-coloured, the lower lobes are strongly hypostatic, bronchial mucous membrane covered with a pretty abundant white reddish mucus. Right lung in similar condition. The lower lobe not quite so hypostatic, slightly ~~stick~~ adherent to the middle lobe. The spleen small, firm, but somewhat friable, the capsule delicate, somewhat roughened the substance contains much blood, wa-

becomes distinct. A solution of iodine yields no amyloid reaction. Left kidney of normal size, capsule may be taken off readily, surface smooth, substance shows distinct markings on section, boundary lines normal, cortical substance congested, no reaction with Iodine. Right kidney exactly as left. Stomach somewhat contracted, very pale, contains little grey brownish chyle. Considerable injection of mucous membrane around the pyloric end. Here and there ecchymoses and slate coloured discoloration along the great curvature. Liver strongly hyperaemic; gall-bladder contains 200 grm. greenish black bile. The surface shows in some places whitish yellow fatty degeneration especially on the under surface of the right lobe. On section yellow appearance is seen with some red spots scattered over it. Weight of entire liver very considerable. No reaction with Iodine. No enlarged mesenteric glands. The omentum somewhat hyperaemic. Pancreas firm and dry, colour normal. Duodenum & jejunum nothing worthy of note. Ileum ~~much~~ very hyperaemic, nowhere ulcerated or swollen. In the lower portion were dark patches resembling haemorrhages, also found in caecum. Colon much congested.

Bladder contains about 30 gm. urine, normal, also ureters. Dissection of brain and spinal cord could not be obtained.

Having thus collected all the available facts, clinical and post mortem, which can shed any light on the subject, it remains for us to consider the pathological process and to look for any possible causes of it.

In the first place, no one will doubt that we have to do with a disease in which the motor, sensory and reflex functions of the spinal cord are impaired, and we should therefore look to the anterior and posterior cornua of the grey matter of the cord as the seat of morbid change.

In the autopsies recorded the condition of the spinal cord is noted in three cases. These of course do not furnish sufficient data upon which to found final conclusions, especially when we remember how easily finer lesions in the spinal cord may be overlooked, and that it is desirable to have the microscopic examination conducted by special experts in pathology. In Dr. Anderson's case which was acute, and might almost be called fulminating, the proper nervous details were perfectly normal, but there was found congestion of the membranes

of the cord and two blood extravasations of considerable extent on the outer surface of the dura mater in the cervical region. This condition can not, of course, be made answerable for the death of the patient, and must be considered rather as a concomitant of the morbid process which also caused the death. In the two other cases, both of a chronic nature softening of the lumbar portion of the cord was found, and in one of them it is noted that the membranes were congested, the capillaries of the softened portion of the cord were distended and there were many small extravasations. Here too we have not enough to account for death, and the softening may be looked upon as the result of prolonged impairment of function. Both the course of the symptoms and this morbid anatomy point to the lumbar portion of the cord as the part first affected. The change in the nutrition of its nervous elements tends to spread upward to the higher portion of the cord, as shewn by the symptoms in the upper extremities, and to implicate the nervous centres of the heart ~~xxxx~~ as shewn by the cardiac symptoms, to implicate also the vaso-motor centres as shewn by the arterial palpitations, and the dropsies.

This change in the nutrition of the nervous centres is of so subtle a nature as to cause no visible alteration of structure in acute cases and is of a kind which frequently permits of entire restoration, although a tendency to recurrence of the morbid condition remains.

The absence of a febrile condition excludes the idea of an inflammatory change.

Death occurs apparently by implication in the morbid process of the nervous centres of the heart and respiration, or by the mechanical impediment to these functions by serous effusions in lungs and pleural.

The derangement of the heart is in the first instance functional. Whether it arises from stimulation of the sympathetic nerve (accelerator) of the heart, or diminished energy of the vagus, or implication of the nervous ganglia of the heart itself, our present knowledge does not enable us to say. But lesions are found in the heart itself, which are apparently secondary to that of the nervous centres, impaired nutrition of it muscular substances and dilatation of the right ventricle through imperfect contraction and impediment in the pulmonary circulation. Valvular lesions are not found.

Similarly the degeneration or atrophy of the paretic or paralysed muscles of the extremities is due to implication of their trophic centres, or the result of disuse, probably both.

The oedema of Kakké seems to me to be one of its most interesting and suggestive phenomena. It is generally in the first instance localized and symmetrical, and in the same area as the nervous phaenomena, and therefore suggest the idea that it too is of nervous origin. It may occur before the heart's action shows any change, where there is no anaemia, nor renal complication. It does not follow the mechanical principle of gravitation, being often over the tibiae or about the ankles, not in the feet. A parallel to it may be found in the oedema which follows injury of a nerve. Mitchel in his work on ~~the~~ injuries of the nerves, says "Nutritive changes in the connective tissue are common after nerve wounds, and are first seen in the shape of oedema local or general in the limb affected." A centric change may therefore well produce a similar condition.

The general anasarca and the serous effusions which occur in graver cases of

long standing are an exaggeration of the local oedema and to be accounted for on the same principle, but doubtless furthered by an anaemic condition and the embarrassment of the heart's action. We cannot, however, be considered to have solved all the problems of the case, even when we have demonstrated the existence of hydraemia. Wernich's view of the pathology of the disease is that it is essentially an alteration of the blood, analogous to cachectic dropsy, pernicious anaemia, and chlorosis. "The blood serum", he adds "loses the faculty of remaining in the circulatory organs and soaks through the tissues or gathers in enormous quantities in places where most room is to be found." Apart from the fact that it has been shown that anaemia is not an essential factor in the disease, this is an inadequate explanation of the dropsy. Experiments made by Cohnheim and Lichtheim to determine the nature of hydraemic oedema by injecting solutions into the circulation of lower animals, show that alteration of the blood by itself is insufficient to produce it. In all the cases, even when the largest injections were used up to 92 per cent.

of the weight of the animals, there was no evidence of cutaneous oedema, the subcutaneous connective tissue being invariably perfectly dry. The most striking results were dropsical effusion into the abdominal cavity and oedematous swelling of the pancreas and gastro-intestinal walls. The pericardial and pleuritic sacs contained no fluid, nor was there any oedema of the lungs, except in the few instances where death resulted from this accident. The central nervous system and subcutaneous connective tissue were also invariably free from oedema. They conclude that in oedema two factors must cooperate, hydraemia or hydraemic plethora and a morbid condition of the walls of the vessels, and consider it probable that a long continued hydraemia itself brings about this condition of the vessels. (quoted from Virchows Archiv. 1877 in Liemsen's cyclopaedia) I would add that it is also probable that this condition may be brought about by the direct action of the vaso motor nerves. These experiments endorse the views of Laycock advanced upon clinical grounds many years ago in his Clinical Inquiries into the Influence of the Nervous System and of

diathetic tissue-changes on the production and treatment of dropsies. He maintains that there are 'neuro-vascular areas' in anasarca, that the distribution of anasarca is not always governed by gravity, that facts do not sustain the 'bottle-filling theory', that there is a prior condition required for the effusion, which seems to be either a condition of the living tissues, or of their capillaries. He argues that in cardiac and renal dropsy it advances pari passu with pulmonary and cardiac congestion, but then, the latter existing to the same degree, results are in some cases extreme dilatation of the right heart, haemoptysis, or death by pulmonary apoplexy with little or no anasarca. What makes the difference? Is it hydraemia? But this is often not very manifest in cardiac general dropsy, and in some cases dilatation of the heart and pulmonary congestion are consecutive to the anasarca. But then, it is said, the vessels were first weakened by anaemia, so as to allow transudation of serum, this becoming an impediment to the circulation and requiring greater cardiac effort, hence dilatation. There are causes which being general affect both sides alike. Where

oedema is unilateral there must be therefore an additional element. He gives cases in support of his argument and concludes among other points that the nervous system taken as a whole, or else some special division of it, has a direct influence both on the production and prevention of anasarca; that anasarca is produced when innervation is defective; and that production or prevention alike follow upon changes in innervation which are induced in the same way and according to the same laws as other neuroses.

Brunton in an article in the Practitioner (Vol II. 1878) quotes the experiments of Renvier and of Goltz on the dog in which the lower vena cava having been previously tied, dilatation of the vessels and oedema followed on that side section of the sciatic or section of the sympathetic fibres passing to the sacral plexus, while only motor paralysis followed division of the motor strands as they issued from the lumbar vertebrae before they were joined by the sympathetic fibres, thus "showing conclusively that dilatation of the vessels by paralysis of the vaso-motor nerves is one factor in the production of oedema".

Following out this line of thought it is not difficult to construct a theory of the modus operandi of the vaso-motor nerves in the production of dropsy. Inasmuch as dropsy is an exaggeration of a normal process of transudation of fluids from the blood-vessels to the tissues around them, which process is under the regulation of the vaso-motor nerves, we have a priori reason to consider that derangement of their regulating power may cause dropsy. The opposite process of shrinking of the tissues and deficiency of fluid in them, as in the cold stage of ague is due to the constriction of the vessels of the surface under the deranging influence of the ague-poison upon the vaso-motor centres; and this affords a presumption by analogy that oedema may result from the dilatation of vessels under paralysis of vaso-constrictor, or stimulation of vaso-dilator nerves.

It appears that mere obstruction to the return of blood by ligature of a vein may not be sufficient by itself to cause oedema, also that division of a vaso-motor nerve by itself does not lead to oedema, but that both these interferences together do. It also appears that injury of a whole

nerve including sensory, motor and vaso-motor fibres frequently lead to oedema. Hence we are led to the conclusion that the altered nutrition of a part which is brought about by division of it motor and sensory nerve-supply, may have the same effect, so far as oedema is concerned, as obstruction to the return of blood. A diminished power in the tissues of appropriating the nutrient material of the blood, co-existing with increased blood supply by derangement of vaso-motor nerves, may be the cause of stagnation of the nutrient fluid around them, or a disturbance of the equilibrium between the intra-vascular and extra-vascular fluids which constitute oedema. A central lesion involving sensory, motor and vaso-motor centres may therefore be supposed competent to produce oedema.

The problem of the causation of dropsy is much more complex than the mechanical theories usually advanced suppose. Any theory which ignores the vaso-motor system of nerves is inadequate. The considerations which I have advanced tend to show that the part which I suppose to be played by the vaso motor nerves in the produc-

tion of dropsy is not inconsistent with physiological principles, and affords an explanation of the oedema of Kakke which the ordinary views of the causation of dropsy fail to do. The palpitation of the arteries and the pulse of low tension observed in Kakke afford additional clinical evidence of a derangement of the vaso motor centres in Kakke.

With a view to the Aetiology of the disease we must consider the facts connected with climate, season, locality, age and sex, race, habits & hygienic conditions of the people generally.

Climate. The Empire of Japan lies between latitude 31° N. & 45° 50' N., its capital, Tokio, being under the same latitude as Malta. One might expect therefore that its climate would be similar to that of the south of Europe. As a matter of fact it is both colder in winter and warmer ~~than~~ in Summer. One cannot speak, however, of the climate of Japan because there exists a considerable difference between the extreme north and the extreme south of the empire. The island of Yesso in the northern portion is colder in winter than the north of Scotland, and the southernmost portions of Japan have a

winter much milder than that of the south of England, while the summer is much hotter. The place of my residence was the treaty-port of Niigata on the West Coast, lying under latitude 37°.55'. Its mean annual temperature is 13.1°C. The west coast generally is colder than the opposite side of the island being more exposed to the N. & N.W. winds from the continent of Northern Asia. The winter in Niigata is long and severe with considerable fall of rain and snow and prevalence of strong, cold, raw winds. Snow covers the ground in the flat country round to a depth of, not uncommonly, two feet, and in the higher-lying districts to a much greater depth. Dr. Rein, in his recent work on Japan, remarks. "If we compare with the temperature of Niigata those of several places in the same latitude, we find that the yearly mean for San Francisco is 13.5°C., for Athens 17.7°C, and for Palermo 19.5°C., or about 0.4°C., 4.6°C., and 6.4°C. higher respectively. In Niigata, January and August as the coldest and warmest months respectively have mean temperatures of 0.9°C. & 26.4°C. In San Francisco on the other hand, January has a temperature of 9.8°C. and September on the other hand

as the warmest month only 16.2°C. Thus in the latter case, there prevails a marked sea climate, and in the former case an almost continental climate."

A notable feature of the climate throughout the country is the predominance of warm moist south winds in summer and raw northerly and north-westerly winds in winter. The strength of the direct rays of the sun together with the cold winds in spring are a cause of a prevalence of catarrhal affections at such time.

Another important feature of the climate is the prevailing moisture. Dr. Rein says that "on the average the relative moisture amounts to 82% for the warm season, 71% for the cold season and 76% for the year." With regard to the rainfall - "There are but few districts in the world which compare with Japan as regards the quantity and distribution of the yearly rainfall. This would chiefly be the case with the Gulf-states of North America, where likewise the summer is the rainiest season of the year, and the quantity of rain equals that in Japan"

Hence, as might be expected, Japan possesses almost all the diseases of temperate climates and some of those which

are generally find in tropical climates. The excessive moisture in connection with the great summer heat is favourable to the production of miasmatic poisons. Hence a prevalence of malarial diseases. It must also be remembered in the same connection that Japan is one of the most mountainous countries in the world. Its rivers are rapid and of short course, carry down with them a great deal of alluvial deposit, and are liable to swell and to subside again rapidly. Another fact to be borne in mind is that rice is the chief crop. Every available spot high up in the valleys, and on the mountain-slopes is terraced into paddy-fields, and every plain over which water can be led is under cultivation for rice. Hence the sub-soil is perpetually saturated, and in dry seasons and towards the end of summer these areas as well as the shallow margins of the rivers are apt to become partially dry mud-beds, which are a fruitful source of malarial exhalations.

The combined heat and moisture lead to a diminution of vascular tone and depression of nervous energy.

Season. The season of prevalence of Kakke is that of increased heat and moisture.

In rainy summers it is especially frequent and severe. In the winter months only the chronic form is met with, or what may be considered sequelae of the disease. According to Anderson's observations in Tokio "the early cases occur at the beginning of June, or in the latter half of May; in July the number is largely increased; the maximum is reached in August, and a sensible decline is noticed towards the end of September. From December to March an out-break is rare" Dr. Simmons remarks that Kakké patients bear very ill any sudden change in the temperature.

Of 52 cases of Kakké occurring in my dispensary practice in Niigata in twelve months, the following is an analysis as to time and character.

Jan	3 (chronic)	July	7 (3 chron. 4 subac.)
Feb.	1 do	Aug.	14 (8 chronic 6 subac.)
March	2 do.	Sep.	3 (chronic)
April	7 (2 chronic 5 subac.)	Oct.	5 (3 chron. 2 subac.)
May	2 (chronic)	Nov.	2 (chronic)
June	3 (2 chronic, 1 subacute)	Dec.	2 (chronic)

The division into chronic and subacute is one however which does not admit of any very sharp distinction, and in some cases I have been doubtful which to call it.

Locality.- Upon this point more exact information is desirable. The disease appears to be endemic in the large centres of population, the chief cities of Japan. These are frequently built upon alluvial soil at the mouth of the larger rivers, and are imperfectly drained. But the disease is not confined to these localities. Hakodate is situated on the slope of a hill by the sea-side, and the disease is well known there. Niigata is built upon a strip of alluvial soil between the mouth of a river and the sea, partly sandy, partly swampy. A rise of the river or heavy rains causes the town to be partly flooded. The disease though well known, rarely occurs in its severest forms. All writers on the disease in Japan, however, incline to a belief that a low-lying ill-drained soil is an important factor in the production of the disease. Eldridge says "In certain districts, generally but not invariably lying low and near the sea-coast, the disease is rarely absent, while within these districts there appear to be foci at which the cause of the malady manifests itself with greatest intensity. In other perhaps closely neighbouring localities

generally inland and of higher level, it never generates de novo." Simmons also states that the disease is "limited to well defined localities, and not often observed to spread beyond them except from well-understood causes." He justifies this statement by reference to the topography of Yokohama and the prevalence of Kakke in certain localities there and not in others. The disease prevailed in the swampy level on which the native town was built, and in certain institutions, in which the sanitary arrangements were good, but which were built on the slope of the adjoining bluff, facing the swamp. In certain other institutions with inferior sanitary arrangements but built on the opposite side of the same bluff, the disease did not occur. This difference he attributed to the fact that the south-westerly winds of summer carried the poison of the disease from the swamp where it originated to the hill-side exposed to them, while the other side of the hill was sheltered from these winds. This is a plausible theory, but a wider observation of facts is necessary. From what I have heard of the prevalence of the disease in various parts of the

country, it has seemed to me very doubtful whether the areas of its prevalence are at all sharply defined. On the other hand the Japanese are very much given to travel. Hence, if, as there is reason to suppose, the disease may remain latent for a considerable period, the possibility must be borne in mind of its having been contracted during a temporary residence in a place, and not manifesting itself till long after.

Age.— The disease does not attack the very young nor the aged, chiefly those in middle age. Of 52 patients of mine the distribution as concerns age was

from 15—20, 13; from 20–30, 18;
from 30–40, 15; from 40–50, 5;
from 50–60, 1.

In a report of the Kakke Hospital quoted by Simmons out of 85 patients

1 was under 15; 14 were fr. 15–20
50 were fr. 20–30; 11 were fr. 30–40
9 were fr. 40–60.

Sex.— Women rarely suffer except in the puerperal state. Of 52 cases of which the particulars were noted by me, only one occurred in a woman.

Race.— No cases of Kakke have been known to occur among foreigners

resident in Japan.

Habits and hygienic conditions.— No connection can be established between any article of diet and Kakké. The staple food of the people is rice and fish. They have of late years begun to consume beef, and milk. There is no lack of fresh vegetables. Bean-curd prepared in a digestible form is a favourite and daily article of diet. On the whole the people are fairly well fed. Kakké occurs as much or even more among the well-nourished, than the under-fed.

The homes and social life of the people reveal several unsanitary conditions, and we may fairly reckon among predisposing causes whatever lowers the general health and reduces the power of vital resistance to the morbific agency whatever it may be. Among these bad ventilation is prominent. Their method of heating is by charcoal fires without any escape for the fumes. The same rooms are used as sitting and bed-rooms. At night outer shutters are closed, while a large number of people lie huddled together on the mats on the floor. Whatever fresh air enters is by unintentional leakage. The common use of paper instead of glass, which being unsized permits an inter-change of gases considerably mitigates the

injurious effect of their indifference to ventilation. Their privies are often so situated that the effluvia pass into the dwelling. They have no sewerage, but the contents of the privies remain in open wooden vats, and are emptied only when full to be thrown over the fields, so that the proximity of open spaces is often the reverse of being the means of securing pure air.

A national institution is the hot-bath, which is indulged in not merely for the sake of cleanliness, but as a luxury and as a method of warming the body in winter. It is resorted to by all classes as frequently as once in two or three days all the year round, and a temperature of 105° F. is for them a moderate heat. Probably less harm follows than we might expect because it acts as a rubefacient, the effect lasting for a little while, but it is impossible not to believe that it has a debilitating effect.

There is a lack of out-door exercises and manly sports among the young men. Too early marriage and sexual incontinence are also a cause of defective development. Prostitution is a recognised institution and syphilis is rife. Intoxication with a fermented liquor brewed from

rice, and of recent years with imported European alcoholic drinks, or vile imitations of them is a not uncommon vice. The same effects of chronic tippling are observed in Japan as in Europe.

These and other unsanitary arrangements in the ordinary life of the Japanese tend to keep them at a low degree of physical vigour, so that they more easily succumb to a morbid poison, but no direct relation can be traced between any of them and Kakké.

It has seemed to me, however, that the habits of the Japanese in sitting and walking were a probable cause of defective innervation of the legs. Their custom is to sit upon their matted floors with the legs bent under them, the back of the thigh in contact with the calf of the leg, the foot extended and turned inwards, so that the skin over the outer malleolus, (which becomes horny in every Japanese in consequence,) is in contact with the floor, and the whole weight of the body compresses the leg on the floor. In this position meals are eaten, business is transacted, friends sit in company, the clerk or the student sit at the desk, and an audience sits

to hear a public speaker. To sit in any other position is impolite, and is never done without permission asked or at the express request of your host. One of the most marked features of the Japanese character is their punctilious politeness and rigorous regard for etiquette, which would lead them to endure considerable discomfort without betraying it rather than violate propriety. The foreigner cannot endure the position for more than a few minutes, but the Japanese, inured by long use, can maintain it for several hours. Still it is an usual thing with them after a protracted sitting to experience numbness, stiffness, pain and difficulty of extending the legs. Mr. Faulds of Tokio mentioned to me a case of paralysis of the legs in a heavy man who had sat for three consecutive days in this position absorbed in watching wrestling-matches. Wrestling is the athletic sport of Japan which excites the keenest interest, and occasionally a competition takes place between the champion wrestlers which is continued for several days. He was unable to walk or stand but recovered the use of his limbs under appropriate treatment.

I once saw in consultation a prisoner who suffered in the same way in consequence of prolonged confinement in this position, who also recovered under passive motion, faradization, strychnia and the gradual use of the limbs. A similar case was that of Père Sidotti, a Romish priest, who, after the proscription of the Christian religion in Japan, was landed there in the year 1708. An old Japanese manuscript giving an account of him has recently been translated. He was imprisoned and carried about in a small cage from which he was not allowed egress for some time. Being carried from Nagasaki to Yedo, a journey of over 300 miles, in it, the cramping of his body in a squatting position had deprived him of the power to walk which he never afterwards regained.

The Japanese custom of wearing clogs raised two or three inches above the ground and held only by the thong, passing between the great toe and the next, appears to me to act injuriously also. The effect is that in walking the heel is never firmly planted on the ground, and their walk becomes a shuffle in which the knee is never braced.

It seems difficult not to believe that

their method of both sitting and walking acts as a predisposing and possibly also as an exciting cause of defective innervation of the lower extremities. Such a posture involves continued pressure upon the nerves and interference with the circulation. That it may be an exciting cause is rendered probable by the fact that those who live a sedentary life are particularly liable to the disease, — students, apprentices, and such like. In former times those whom etiquette compelled to squat in the presence of the feudal princes for considerable intervals were said to be very frequently the victims of kakké. Agricultural labourers and open air workers are rarely attacked. That women are frequently attacked during their confinement is not surprising when we learn what their method of treating the puerperal state is. The hips are bound tightly for 30 days, sometimes so severely as to cause ulceration. For a period of three weeks the woman is kept in the squatting position above described, day and night, supported by bedding around her, while she is kept on a diet of rice, & salted and dried unripe plums; unless sheer exhaustion compels them to mitigate the rigour of the practice.

Among exciting causes of Kakké, exhaustion from over-work and exposure to wet and cold appear to take a prominent place. Unusually prolonged standing and walking, working with the feet and legs in the water, as in fishing and the handling of timber, appear frequently to determine an attack of Kakké. Policemen who are put into leather boots and made to stand and lounge about for unreasonably long hours while their feet are wet are particularly liable to be attacked.

According to Anderson overcrowding and bad ventilation is a powerful exciting cause. He remarks "The defective sleeping accommodation on ships appears to be especially active in determining an outbreak of the disease in those who have previously lived in a Kakké district. A striking example of this occurred in the summer of 1875 amongst the crew of a Japanese vessel lying at anchor at Yokosuka. Out of 300 sea-men, about 70 (the exact number could not be ascertained) were attacked by Kakké, over 20 died in a very short time, and 47 were afterwards sent for treatment to the Naval Hospital. Fifty other men were at the same time prostrated by various diseases. Enquiry

showed that the food, clothing and exercise of the sailors were satisfactory, but that nearly the whole crew slept during the night in a space allowing only 32 cubic feet per head, while owing to the place of anchorage of the ship the air respired was almost stagnant. After a medical examination the sleeping arrangements were at once altered by the Admiralty and as a result the epidemic almost immediately ceased."

A prevalence of hot and damp, close steamy weather appears also to be favourable to the outbreak of Kakké. This is specially insisted upon by Dr. Wernich in comparing the endemics of 1875 and 1876. The former year was characterized by a prevalence of such weather and of the disease, the latter was an exceptionally dry and warm summer, until September when a prevalence of depressing moisture was accompanied by an out-break of the disease which had occurred only quite sporadically up to that time. It is also a matter of common observation.

Having thus enumerated the facts which have any bearing upon the aetiology of Kakké, it remains to consider whether we can form any theory of its

pathogenesis. It is easy to cut the knot by supposing a specific poison, allied to malaria, of unknown nature and origin, which is the cause of all the symptoms. But before resorting to this hypothesis it is necessary to exclude other possible and more simple explanations of the facts.

Dr. Handfield Jones in the Lumleian Lectures in 1865 on some points in the Pathology of Nervous Diseases seeks to establish the existence of a primary functional form of paralysis, that is, not dependent on any exudation, extravasation or other evident organic alteration. After mentioning as a normal analogy, sleep, which is such a temporary paresis pour exhaustion, he adduces some kinds of infantile paralysis, with no sign of central organic disease, chiefly characterized by debility, evanescent and curable by tonics; also cases due to exhaustion, as paraplegia pour excessive coitus, leaving no p. m. trace of organic lesion, macroscopic or microscopic (Gull); to exhaustion pour excessive exertion, especially when added to sexual excesses; cases of paralysis pour alcoholic abuse, pour debility attending epidemic catarrh; other

obscure cases of paralysis without organic lesion; diphtheritic paralysis; cases of over exertion or injury followed after a while by disintegration of the tissue of the cord without exudation in it or its membranes; cases of temporary paralysis of the ciliary muscle of the eye as a result of various debilitating disorders; nervous debility caused by heat, heat-apoplexy and its after effect, & various indications of nervous derangement from enfeebling climatic influences without organic lesion; night-blindness as a functional paralysis often due to various debilitating causes, & remediable by better nutrition and tonics. He also quotes malarial cases which I should consider due rather to the direct action of a poison. He considers it highly probable that vital exhaustion and functional incapacity may, if extreme, pass into actual decay of structure, into a state of irreparable organic lesion. He concludes, - "The general conclusions which the above review inclines me to adopt are that primary paresis of ganglion cells in the nerve-centres, encephalic, spinal, or sympathetic is a condition of rather frequent occurrence, that it is commonly the result of ex-

feebling and prostrating influences, acting for a longer or shorter time, that its phenomena may set in suddenly, that they are not dependent on general or local anaemia or on reflex irritation, that it is attended with no visible structural ~~structural~~ change in the early periods of it existence; but that, if prolonged considerably, it may become complicated with atrophic degeneration, and that the remedies suited to it are all such as can excite and maintain nervous power. If so, functional nervous paresis deserves to be most distinctly recognized in our nosology and not merely tacitly admitted as a matter of probability."

In accordance with these conclusions it seems to me a sufficient explanation of the symptoms of Kakké, without invoking Malaria, to regard it as a primary functional paresis of the sensory, motor, & vaso-motor centres of the cord, caused by a combination of depressing influences, which may vary in different cases, but which have been already enumerated. Prominent amongst these I would place climatic influences, and the depressing effect of sexual in-

dulgences, and of their Japanese method of sitting. These two latter probably render the lumbar portion of the cord peculiarly vulnerable and determine the siteis of the disease on the lower extremities. (It may also afford an explanation why young men should be peculiarly liable to the disease. It is remarkable however that men are more liable than women to paraplegic affections. Of 171 cases of paraplegia observed by Brown Sequard, 125 occured in men, 46 in women.) The acute and fatal cases are probably due to a similar affection of the centres in the medulla oblongata. The Japanese suffer from a variety of ill-defined nervous complaints which may be grouped as neurasthenia. Their nervous system is that of a developed and civilized race. The diseases supposed to be peculiar to modern life are as common amongst them as amongst Europeans Dr. Wernich lays stress upon a peculiarity of the Japanese constitution which he calls an 'instable equilibrium of the circulation'. He considers that deficiency of nourishment containing fat and albumen, the influence of a moist warm climate, and the widely open coast

give a foundation for the disposition in every individual born of a Japanese mother. However this may be there certainly exists in them an unusual excitability of the vaso-motor nerves. An indication of it, which every foreigner must have observed, is the remarkable effect of small quantities of alcohol upon them. Without other symptoms of intoxication, a single glass of wine or a few ounces of their rice-beer causes at once a crimson flush of the whole face and prominence of the veins which lasts for a little time and betrays their drink. This sensitiveness of the vaso-motor system, doubtless predisposes them to functional derangements of it. Foreigners resident in Japan also frequently fail in health from various forms of neurasthenia, and it is remarkable of this class of cases, as of Kakké, that the general appearance is that of good nutrition and fair general health, which is deceptive as to the reality and importance of the disease.

I may perhaps be thought to have laid too much stress upon the injurious manner of sitting of the Japanese. Abundant clinical facts, however, show that an impairment or

suppression of function of nervous centres may be caused by a peripheral impression. Fainting under pain, death from shock during or after surgical interference are notable instances. It is in harmony with many clinical observations to suppose that as the sudden and severe impression causes an instantaneous and dangerous or even fatal "reflex paralysis", so prolonged and repeated pressure upon a nerve may cause a paresis of it nervous centres, or a condition under which they fail on slight additional provocation. "Reflex paralysis" appears to be looked upon with disfavour and suspicion. Setting aside however Brown-Sequard's theory of spastic ischaemia of the cord as too fanciful, and allowing that many cases may be referred to an ascending neuritis implicating portions of the cord, there remain a large number of well authenticated, however inexplicable, cases in which a paresis or paralysis of remote nervous centres is caused by peripheral impressions. It has also been proved that strong irritation of distal parts (cutaneous nerves) may exert an inhibitory action on tendon-reflexes. (Nothnagel and Lewinski, Arch. f. Psych VI. 1876. Ibid. VII. 1877 referred to by Liemsen)

Inconclusive as these hypothetical considerations must be, they seem to me preferable to the hypothesis of a malarial poison. Japan undoubtedly presents favourable conditions for the development of miasmatic organisms. That malarial influences are capable of producing functional paralysis there are facts to show. Intermittent paraplegia due to malaria, & amenable to quinine is also described. Kakké is entirely different, however, from malarial diseases proper, in that it presents no fever and no periodicity, and that quinine has no decided effect upon the disease. Hence those who have considered it malarial, have used that word in the wider sense of some unknown but specific miasmatic influence, analogous to ague-poison, but differing from it. The arguments for it are from the distribution of the disease. On this point however further investigation is desirable. Certainly the acute forms of the disease are suggestive of the action of a definite poison upon the nerve-centres. These however are the exceptional, rather than the typical and common cases. It appears in favour of the malarial hypothesis that change of air

is frequently the most efficacious treatment. The mysterious latency of the disease, and the tendency to recur under slight provocation are further points of similarity to malarial disease. It is obvious that until we know more definitely when and how the supposed poison enters the system, we cannot speak with certainty of its period of incubation or latency. Dr. Anderson narrates an epidemic upon a training-ship, from which it would appear that the poison, if it exists, may remain latent in the system for six months. "In the beginning of November, 1875, a training ship, the Tsukuba-kan, left Yokohama for San Francisco with a crew of 250 men, 60 officers and cadets, and 3 English instructors and returned on the 14th. April, 1876. Throughout the voyage cases of Kakké appeared at the rate of about two or three in a week, although the ship was distant from any possible source of infection, and was itself kept in a perfect state of cleanliness, and despite the more remarkable fact that the period of the year was precisely that in which Kakké is most rare in Yedo. One fatal instance happened just before the arrival of the ship in Yokohama, upwards of

six months after the patient had left Japan. The total number of cases was about sixty, all of which occurred amongst the crew; the officers and cadets who were better lodged and fed, being quite exempt. The determining cause appeared to be the overcrowding that must always exist in a fully-manned ship, and this was probably assisted by exposure to bad weather, to which the recently recruited crew had not become inured, and possibly by a diet which, though unobjectionable under ordinary circumstances, was not sufficiently nutritious to maintain the amount of vigour requisite to resist the depressing conditions of sea-life."

The above history tells more of a combination of insanitary conditions than of a latent poison, and rather suggests that the materies morbi may remain undeveloped for indefinite periods in those who are well cared for.

It must be admitted however that there is on the whole a presumption in favour of a specific poison.

There is nothing in the history of Kakke to indicate that it may be spread by infection from one person to another, nor have I ever heard of this being even suspected by anyone, native or foreign, lay or professional.

Thus far I have confined my attention to the phaenomena of Kakké as the disease occurs in Japan, without reference to Beriberi, and have done so because it seemed to me to conduce most to lucidity to obtain a picture of the disease in Japan, and the conclusions which may be formed upon it. It has been generally assumed that the diseases are identical or nearly allied. The views of medical authorities in India, however, have been so much at variance on the nature of Beriberi that it is no easy matter to sift and weigh their statements and opinions. The difficulty is increased by the latest authority on the subject, Dr. Chevers, who in a paper read before the Medical Society of London on March 31st. of this year on Beriberi, which he designates Febris Exanthematosa Orientalis or Beriberi Fever, propounds the doctrine that "acute beriberi is an exanthematous fever, hitherto best known by its sequelae, — acute general anasarca, and frequently but not invariably morbus Brightii and paraplegia". If this opinion is to be accepted there is an end of difficulties, because in that case it is evident to any one who has studied the disease in Japan, that Kakké cannot be brought under Dr. Chevers's definition of Beriberi, and the disease

must be distinct. There is no exanthem in the Japanese disease; fever is generally absent or if present is trivial and not in proportion to or due to the symptoms of Kakké. What Dr. Chevers describes as the sequelae are in Japan the early manifestation of the disease. Dr. Chevers has concluded that an epidemic which prevailed in Bengal and the Mauritius in 1877 and 1878 was typical acute Beriberi. In order to believe this we must suppose that other observers have been very unobservant, and that they have as Dr. Chevers says of Malcolmson "commenced their description of the symptoms at the beginning of the end", or else that the disease has undergone a change of type, and only assumed its true character for the first time in the recent epidemic. Finally we have the alternative of supposing that Beriberi is not one but a group of diseases.

Another source of confusion in studying the disease in India is that we have the two terms Beriberi and Barbiers, which are treated by some as the same disease by others as distinct. Barbiers appears to be the form of the disease characterized by more or less paralytic symptoms without dropsy, and Beriberi to be restricted

to that in which anasarca forms the most prominent symptom. Materials are wanting for a careful comparison of Barbiers with Kakke.*

In Johnson and Martin's work on the influence of Tropical Climate on the European Constitution, 1841, is an account of Beriberi by three separate observers, Christie, Hamilton and Ridley. Comparing the disease in Japan with the account of Christie, we cannot doubt the identity of the disease in the two countries. He recognizes the same varieties in the degree of anasarca and the chronicity or terribly acute character of the disease in some cases. His account of the post mortem appearances agrees with those of the disease in Japan. He notes that he has never seen the disease in a woman, and that the sedentary and debauched are most liable to the disease. Points of difference are that at a late stage of fatal cases "some fever with delirium often accede and terminate the life of the unfortunate sufferer," also that the aged are liable to be attacked. In Japan,

* Note. Scott in the Cyclopaedia of Practical Medicine, and Rochard in the Nouveau Dict. de Méd. et de Chir. regard Beriberi & Barbiers as two distinct diseases.

the aged are exempt and head symptoms do not occur.

Hamilton's and Ridley's descriptions corroborate generally that of Christie. Hamilton found "evident marks of congestion of the spinal cord, particularly in the dorsal region" and was "convinced that it arose in a great measure from obstructed circulation in consequence of congestion in the internal parts, more especially the liver and lungs and that Beri-beri consequently could not be merely a disease of debility as supposed by Colquhoun, Hunter, Christie, and others". ... "Prevalence of the disease during change of monsoons may be accounted for by the damp loaded state of the atmosphere and the extreme vicissitudes of temperature, which by suddenly checking perspiration and producing unparalleled atony of the extreme vessels debilitated by previous excess of action, break at once & with violence, the balance of the circulation" These remarks are interesting as bearing out the importance of atmospheric influences, and the fact of visceral congestion and disturbed balance of circulation which I have attributed to derangement of the vaso-motor centre.

The accounts of older writers are

summarized in an article by Scott on Beriberi in the Cyclopaedia of Practical Medicine, London, 1833. Dr. Rogers who had studied the disease in Ceylon, made it the subject of a Thesis presented to the University of Edinburgh in 1858 under the title Hydrops Asthmaticus. Cases in which the cardiac disturbance with dropsy and dyspnoea were prominent over the spinal symptoms appear to have been specially studied by him. Scott object to a name which ignored the paralytic affection of the lower extremities which he considered the more constant symptom. Scott's general description identifies it with what has been described as the dropsical form of the disease in Japan. He adds that "in 1815 in Ceylon in some cases which came under his notice the external or amaurcous symptoms were apparently unimportant, although death was the result. Some of the patients expired who appeared to be recovering and who stated shortly before death that they were better. The dropsical symptoms did not by any means appear to be the immediate cause of death and Dr. Christie state that some of his patients died who had no decided amaurcous symptoms; the face was however bloated."

It prevailed in Ceylon from 1795-1803, and its ravages were such among both European and native troops that it earned the title of "The bad sickness of Ceylon".

Observations as to its aetiology in Ceylon are discrepant. Christie, Rogers and others in Ceylon considered it a disease of debility from bad air and food and exposure to a moist and marshy atmosphere while debilitated by residence in an unhealthy station. On the other hand Scott remarks that in 1815 in Kandy troops and followers were exposed to variable weather, privation in regard to food, and other causes of physical and mental exhaustion, but beriberi did not supervene (Marshall); while in Trincomalee those who adopted every precaution as to food and clothing were mortified to find the disease not checked by their prophylactic measures. In Trincomalee 200 Europeans died of it in the year 1795. It is noted that those of sedentary occupation were especially attacked, while officers, women and children were generally exempt.

Scott is inclined to consider the dropsical affection as the result of inflammation; in what way, he does not say.

In diagnosis he puts paralytic symptoms first and this 'with dyspnoea and dropsical effusion appear sufficient to distinguish it from other diseases'.

I have not been able to obtain access to Malcolmson's monograph on Beriberi. His experience of the disease led him to entertain the opinion that 'the chief part of the disease was in the spinal cord and it membranes', and he describes serous effusion and congestion of the cord and 'in one case an effusion of reddish coagulable lymph on the posterior surface of the theca at the 4th. dorsal vertebra and the same in the region of the sacrum'. His testimony is interesting to observers of the disease in Japan as to the reality of the symptoms* referable to the spinal cord, because some describers of the disease in India appear doubtful whether the symptoms were merely stiffness and heaviness of the limbs from oedema. On the other hand the organic lesions of the cord are not uniform and in some cases are entirely wanting, so that they cannot be considered as the basis of the disease any more than the congestions and serous effusions in other viscera, but rather as results of the disturbance of circulation which is one of the symptoms of the

disease. It is important to remark that the spinal symptoms are hardly referable to serous effusion on the cord, because they are often the first symptoms of the disease, both in India, as Malcolmson has pointed out, and in Japan, whereas the effusions take place in the late stages of the disease. It is therefore not in harmony with the facts to regard these spinal symptoms as sequelae.

The view of Ranking that Beri-beri depends mainly on a form of Morbus Brightii has not been supported by anyone else. That congestion of the kidney, as of other viscera, occurs is abundantly shown by autopsies, and Bright's disease may accidentally coexist, but has not been shown to have any essential relation to the disease.

Morehead's description of the disease (Researches on Disease in India, 1860) corresponds with that of others in the main. His pathology is as follows:- "Beriberi is in my opinion a general dropsy of complicated character. A state of the system in which the blood is sufficient in quantity and its water in undue proportion is the predisposing condition; and cold or wet is the exciting cause; no doubt in some instances the effusion is further favoured by coexisting

lung, heart, or kidney disease." "The disease more particularly in its acute form will be found to present itself in individuals favourably circumstanced for the development of a scorbutic taint, and who, while in this diathesis, have been exposed to the sudden cooling of the surface of the body pour sudden alternations of temperature or of wet." His conclusions appear to be based upon personal observation in only four cases. No mention is made of symptoms referable to the cord; failure of motor power is mentioned in two of the cases as a waddling gait pour stiffness and swelling of the thighes and groins. Two of them were fatal and autopsies were obtained, but nothing more striking discovered than slight effusion in the cavities, fluid blood in the heart, congestion of the viscera; spinal cord not mentioned, blood normal under microscope. He remarks on these "It is true that the external phaenomena of scurvy were not present: in two the gums were discoloured, but not swollen and spongy. But in order to explain the disease the actual presence of scorbutic phenomena is not necessary" He argues that the diathesis required time for its development, adduces the fluid condition of the blood, the feeble action of the heart

not due to mechanical causes, it dilated ventricles, & failure of it muscular fibre, with death from syncope, in support of his view. He seems to have been led to this view by the occurrence of an epidemic in 1852, among a crew of Lascars from Bombay. Out of 65 men 35 were attacked and 10 died. The officers and passengers who used anti-scorbutics and whose general hygienic conditions were better were not attacked. It commenced after 2 months and 18 days at sea, and they were on short rations. The captain described the symptoms as pain in the feet, loss of strength down the legs, pain in the chest, dispicuety of breathing and constipated bowels. There is here no evidence of scurvy, but an additional instance how fatal and epidemic the disease may become under accumulated unsanitary conditions on board ship, while on the other hand the evidence of the disease occuring without any scorbutic taint is overwhelming to this theory.

Dr. Horton in his work on on Diseases of Tropical Climates has a chapter on Beriberi, which leaves no doubt that he is describing the same disease as that which occurs in Japan. His experience of the disease was on the West Coast of Africa. There, in addition to the usual symptoms, an implication

of the cerebral centres appears to be common, manifesting itself in torpor and sleepiness, so that the disease is known by the name of the "The sleeping sickness of Africa". Horton says "the mind was very much impaired & the individual spent most of his time in sleeping". A medical gentleman who heard me describe the disease in Japan informed me that he had frequently seen precisely similar cases in Africa with the additional characteristic of great sleepiness.

An interesting account of Beriberi as it occurs in another part of the world is a Report of an outbreak of Beriberi in the Singapore Prison by Dr. Rowell in the Indian Medical Gazette, 1881. The symptoms as he describes them are identical with those found in Japan with considerable anasarca. At the same time he records that "in many instances little else has been complained of beyond rheumatic pains in the limbs and no oedema has existed throughout. The most quickly fatal cases have been such as were accompanied by the least visible outward signs i.e. in men of apparent health." He thus summarizes the morbid anatomy a.) In the generality of cases a most striking and unusual deposition of fat throughout the body.

b.) serous effusions into the areolar tissue throughout the body — absent in many cases, especially those of short duration and suddenly fatal. c.) effusions in chest and pericardium: d.) also in abdomen e.) in ventricles of brain & on surface of cerebrum, and into the spinal canal accounting for paralytic symptoms. Heart pale, ~~congested~~ enlarged, flabby, valves often affected; large masses of coagulated lymph in heart often found; muscle of heart hypertrophied. Lungs oedematous. Kidneys pale, large, flabby. Spleen pale, pliable. Brain sometimes & cord always congested. He considers that there is no doubt that it is the cord which is primarily affected; and he considers it "fairly proved that Beriberi is a malarial poison arising from the decomposition of organic matter in the soil, favoured and strengthened by damp and moisture and is inhaled into the system through the lungs, acting primarily upon the spinal cord. This poison is a great depressor of the vital powers, its first operation being in the quality and distribution of the blood." For this position he advances cogent reasons from the soil, structure and surroundings of the prison, and from statistics which showed its connection with increased

heat and moisture. The prison was built on a mangrove swamp which had been filled in, the surface soil being only two feet. There was no deep drainage. The erection of sluice gates to a neighbouring canal caused a percolation of fluid containing organic impurities pour it to the prison premises. Their erection was contemporaneous with an increase of the epidemic, and their removal followed by the best effects. High walls around cause stagnation of the air, and the floors were near the ground. Overcrowding existed. The drinking water and food were unexceptionable.

These are the most conclusive facts that have yet been brought forward relating to the miasmatic origin of Beriberi.

The mention of an unusual deposit of fat throughout the body in this out-break of Beriberi which I do not find referred to in other English writers corresponds with a mention by Wernich of a Polysarcous as well as a Hydropic variety described by Continental writers on Beriberi.* It appears to indicate a peculiar implication of the hydric centres.

Up to this point the accounts of the disease in various parts of the world and by different observers do not differ essentially.

* A remarkable degree of obesity is noted by Christie.

in the Mauritius in 1878-9, which was called 'Acute Anaemic Dropsy' by some, 'The New Disease' by others, was identified with Beriberi by one and considered to be a form of relapsing fever by another medical practitioner. Information about the epidemic in Bengal is to be found in the Indian Medical Gazette 1880, in papers by Dr. Chambers and others and in the reported discussions of the Calcutta Medical Society; and as to the disease in Mauritius in the same Gazette 1882, in a Report on it by F. Lovell Chief Medical Officer, Mauritius. Precisely the same report is given by A. Davidson in the Ed. Med. Journal vol XXVII. Those who witnessed the disease in India and read the reports from the Mauritius, and vice versâ, identified the two. In Mauritius it was considered entirely different from Beri-beri. In India of those who had witnessed the epidemic and were familiar with Beri-beri, Dr. Coates distinctly denies their identity; while, on the other hand Assist. Surgeon Rammay Roy in a paper on Beri-beri in the Ind. Med. Gazette 1880 states that, having had experience of 300 cases of true beri-beri in the Madras Presidency, and compared the epidemic in Calcutta, he at once identifies the disease, and proceeds to describe the two

together, the description consequently varying considerably from that of those who deal only with the Epidemic. As Dr. Chevers, President of the Epidemiological Society of London, has lent to this view the weight of his authority, it becomes necessary to consider it. It is incredible that so well-marked an exanthem as appeared in this epidemic should be a symptom of Beriberi, and yet have escaped all previous observers in all parts of the world. It is thus described by Chambers, - "a scarlet efflorescence from the beginning of the disease, especially confined to the face, neck upper part of thorax and extremities, or petechial spots with circumscribed measly eruptions on face and trunk, or large purpuric or mulberry patches. In infants, a marbly, mottled, purplish or red tinge of skin, especially of the extremities, neck and cheeks; a flushed puffy countenance with suffused glistening eyes; ~~throbbing of~~ By Lowell it is described as "in most cases subcolar eruption disappearing under pressure, sometimes ending in petechiae, or phlyctenae, and desquamation".

It is equally incredible that the Beriberi poison should have suddenly undergone

this new development.

Again, the epidemic was recognized as infectious and was traced in Mauritius to introduction by Indian immigrants from Calcutta. Beriberi has never been shown to be infectious. A liability to recur is a characteristic of beri-beri, the reverse is the rule in Exanthemata.

Climatic influences and atmospheric changes have a notable effect in Kakke, and Beriberi generally. According to Lovell, "Climate and season seemed to have no influence upon its spread or mortality. It first appeared in the healthy season, after a long drought, but the change of season and the supervention of rains did not stay its progress or modify its character."

It is according to him an acute anaemia caused by a specific miasm using that word in its widest sense. "The poison first manifested itself by its action on the sympathetic system. The vomiting and purging which ushered in the disease indicated vaso-motor paralysis affecting the abdominal viscera." The clinical description given by Chambers, too long to quote here, is undoubtedly that of an acute infectious fever presenting an entirely different tout ensemble from

Kakke and pour the Beriberi of medical literature

Treatment. Prophylaxis consists in a general attention to the rules of health, and especially the avoidance of all such predisposing or exciting causes as have been mentioned in considering the aetiology of the disease. The exemption of foreigners in Japan is probably due to their superior health-conditions.

The treatment of the milder forms of Kakké presents no difficulty. The indication in any case is for nervine stimulants and tonics, especially strychnia, which I generally give in combination with Quinine and Phosphoric Acid. I have found strong coffee helpful in a subacute case. Faradization of the muscles and stimulation of the skin in the paraesthetic areas with a faradic current and wire-brush, I order in all cases with apparent benefit. A continuous current from about 15 cells applied for a few minutes daily from the spine to the feet has also appeared to be beneficial in some cases.

In all cases where graver symptoms appeared, namely, signs of serious cardiac disturbance, or great debility, I urged upon

my patients without delay to remove to a mountain air. Of the great value of a change of air all authorities in Japan are agreed.

In the treatment of symptoms or complications, each case calls for separate consideration. Dr. Anderson has found Aconite to be very serviceable for the relief of muscular pains and cramps; "given in the form of tincture in doses of 15 minims, carefully increased, it has never produced any objectionable results."

The oedema calls for diuretics if it increases beyond a slight degree; large serous effusions for aspiration.

Gastric symptoms must be treated as they arise.

In the treatment of the violent cardiac disturbance and dyspnoea of acute cases, which are frequently the precursors of death, Dr. Anderson has had considerable experience. He states that drastic purgatives, when they act, "almost always give immediate relief without producing any sensible prostration". He recommends 1–2 minims of Croton Oil with 5 grains of Calomel in the form of pill, or 5 grains of Compound Gamboge Pill with $\frac{1}{4}$th. of a grain of Elaterium. In milder cases

he recommends blisters and local depletion by leeches to the chest, but in severer cases prompt resort to venesection. His testimony in favour of it is so emphatic that I here extract it in full.

"Venesection is the most reliable and speedy means of giving relief. As a general rule, the Japanese do not bear blood-letting well, and there would be great hesitation in adopting a form of treatment that has, deservedly or undeservedly, fallen into such utter disrepute in modern European therapeutics; but here death is so imminent that the physician need not wait to consider the remote effects of any operation which offers almost a certainty of present benefit, and, if judiciously conducted, a good prospect of entire removal of the immediate cause of danger.

The amount of depletion must be adjusted to the condition of the patient and the degree of relief afforded. If the operation be performed early, the loss of two or three ounces is often sufficient; but where there has been delay, from eight to fifteen ounces must usually be taken before an effect is produced. In all cases a too rapid flow is objectionable, as it is apt to cause faintness and creates a difficulty in the estimation

of the effects produced upon the dyspnoea.

In the great majority of cases the patient begins to breathe more deeply and to lose the the terrible sense of anxiety as soon as the stream has begun to escape freely, and often smiles and speaks cheerfully before the operation is concluded. The improvement, however, is not always permanent. After about twelve hours the symptoms may recur, though usually in a milder form, and a repetition of the venesection or the use of one of the other measures referred to becomes necessary. Such relapses may appear three or four times in succession, and then, where the treatment is successful the danger ceases. The patient may then rapidly lose all the symptoms of Kakké, or may have still to fight his way through a course of muscular hyperaesthesia and atrophy before he is able to resume his occupation."

It is interesting to observe that Christie recommended the same line of treatment by diuretics and general blood-letting in Beri-beri in India.