

KORSAKOFF'S PSYCHOSIS—REPORT OF CASES.¹

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Several articles have appeared within the last few years devoted to Korsakoff's "Psychosis" or Korsakoff's "Syndrome," but of these only a small proportion have appeared in English journals. The question as to whether it is a disease entity or a symptom complex common to several different conditions has been under discussion and seems not yet to be settled. Additions and contributions to our knowledge on these points are still much to be desired, and it is with the hope of adding, even though slightly, to our knowledge of this condition that I present these five cases.

In the bibliography following the excellent article on Korsakoff's "Psychosis," by Harry W. Miller, pathologist and assistant physician at the Taunton Insane Hospital, which appeared in the *American Journal of Insanity* for January, 1904, and to which I here acknowledge indebtedness, there are twenty-two articles referred to; of these there are but five in English. In the article in "Brain," published in the autumn of 1902, by Sidney John Cole, entitled "On Changes in the Central Nervous System in the Neurotic Disorders of Chronic Alcoholism," there are in the bibliography thirty-eight articles referred to, of which but fourteen are in English, and many of these are devoted to multiple neuritis. Korsakoff published his first article in 1887 and characterized the disease as a polyneuritic psychosis, and suggested the name "Cerebropathica psychica toxemica," as a more fitting designation in view of the fact that the neuritic phenomena might not be prominent. A number of observers took issue with him in his view that the disease was a clinical entity and insisted that it was a clinical picture which might accompany other diseases, and that it was not individual and characteristic.

¹Read by Dr. A. W. Hurd, at the Annual Meeting of the American Medico-Psychological Association in San Antonio, Texas, April, 1905.

In the mental field the most prominent symptoms are memory weakness, persistent inability to retain impressions, loss of orientation, and falsifications of memory. That it is a toxic condition seems to be conceded; that it may be a toxic condition operating upon the central or peripheral nervous system, or both, also seems established. Whether the toxæmia is the result of direct poisoning, or is autotoxic, developed on the field prepared for it by other poisons, is open to consideration. That alcohol is by far the most frequent toxic agent is evident from a study of the recorded cases, but that other causes may be efficient would appear from a small number of cases in which it seemed to follow typhoid fever, lead poisoning, arsenic, tuberculosis, and leukæmia.

The clinical symptoms in the cases here presented, give, I think, a fairly definite mental picture of the condition, and it may recall to the minds of my hearers similar cases coming within their observation.

ONSET AND COURSE.

The symptoms may directly follow an acute intoxication, with delirium tremens, the symptoms of the latter persisting in a milder form with disorientation, fabrications of memory, occupation delirium, memory weakness with or without evidences of polyneuritis. In some the long-continued delirium with some febrile reaction may suggest an acute encephalitis. Other cases may present first symptoms of neuritis with mental confusion and memory weakness coming afterwards. Others again, without evidences of an acute toxæmia, may develop mental symptoms first, to be followed by neuritic symptoms later, and some even have been reported as having the disease ushered in by symptoms of a toxæmia with even epileptiform convulsions, or an apparent apoplectic attack. The disease runs a comparatively long course if the patient does not, as is possible, die from the violence of the toxæmia in the initial delirium. The neuritis may run a course of weeks and months with recovery both mental and physical, as in two of our cases. Others pass through a long course of mental enfeeblement, delirium, and confusion, with pain, paralysis, and trophic ulcers, gradually to improve and even recover from the neuritis, but leaving a degree of dementia, weakness of memory, and confusion, which becomes a chronic condition.

The abstracts of the histories of the following cases have been prepared for me by Dr. Henry P. Frost, first assistant physician, Buffalo State Hospital.

CASE NO. 1.—Man; aged 71; widower; occupation, brickmaker; nativity, England. Admitted January 5, 1905. Said to have had locomotor ataxia for ten or twelve years; pneumonia in 1901 and 1903, and chronic dysentery since the Civil War. Contracted syphilis in early life. Married in 1863; wife bore no living children but four were still-born. Has taken a wine-glass of whiskey before meals for years; became intoxicated occasionally. Drank more than usual last fall after the death of his wife, and his present mental symptoms date from that time.

In the commitment paper it is stated his mind seems to be a complete blank, is wandering and disconnected in conversation, easily confused; imagined that his nurse was his wife, also that his wife was in the next bed to him in the General Hospital. He looks for his revolver under his pillow, etc.

On admission and during his stay (three months), he was quiet, tractable, pleasant in his manner, able to understand his surroundings perfectly and to give a correct account of the remote past but with complete amnesia for everything recent. Constant fabrication; would give a detailed account of what he had done the day before, often relating adventures, such as street fights, in which he punished his assailants. He invariably stated that he "came here this morning" and that he walked all the way. Admitted that he did not feel very well and excused it on the ground that he had been on a "little spree" the night before. Aside from these symptoms his mind was clear and his intelligence unimpaired. No hallucinations at any time while under observation.

Physical Examination.—Patient emaciated; in poor physical condition; weak, requiring assistance in walking; complaint of headache, dizziness, shooting pains in limbs, stomach, and chest; numbness in all of the extremities; prickling feeling in hip and spine and running down the legs.

Eyes.—Pupils normal; no strabismus. Nystagmus in extreme lateral positions, and also when the eyes are turned upward. Vision poor.

Hearing, smell, and taste, all a little defective.

Cutaneous sensibility.—Slight defect of tactile sense in legs and feet; hyperæsthesia to painful impressions; temperature sense normal. Localization of touch good in upper extremities; poor in lower. Muscular sense defective in feet—patient could not tell which toe was manipulated by examiner. Co-ordination good in arms; fair in legs.

Deep Reflexes.—Present in left arm; absent in right. Knee-jerk and Achilles reflex absent in both legs.

Superficial Reflexes.—Plantar and abdominal normal. Cremasteric absent.

Motor Functions.—General impairment of strength; most marked in extensors of feet. Foot drop on both sides. Steppage gait; uncertain station. Tenderness of muscles and nerve trunks, especially in lower extremities. Atrophy of thenar group in both hands.

Slight tremor in tongue, lips, and hands. Fibrillary twitching of atrophied muscles in hands. Sphincters normal.

Patient was discharged three months later. Condition the same as on admission except improvement in general physical condition.

CASE No. 2.—Woman; admitted March 15, 1903; age 27; prostitute; history of gross intemperance for a long time; drank whiskey principally. Some signs of derangement two months before, when she appeared stupid and spoke of things disappearing mysteriously when she really misplaced them herself. About that time, two epileptiform (?) seizures. A week before admission here she had delirium tremens.

On admission patient showed a good deal of confusion; was disoriented in time and place; could not give a correct account of the journey to the hospital. She had no recollection of having seen imaginary objects, etc.

She complained of pain in the eyes and in her feet, which she said were frozen a few weeks ago. There was divergent strabismus; pupils normal; accelerated and feeble heart action; much gastric disturbance, vomiting everything ingested; acute inflammation of tongue and mucous membrane of mouth, tongue being swollen, red, and shiny. Temperature 100°. Pulse 108.

During the first few days patient seemed to be free from hallucinations. She recalled things she had imagined and recognized

them as unreal. She recalled seeing animals and figures "like statues" ranged round a hall; also a woman in black and two men who seemed to be mesmerizing her mother; a girl with snakes twined about her; various animals scattered about, etc. She was fairly composed during the day but restless at night, sleeping very little, taking only milk and beef juice in small quantities, occasionally vomiting. Then for several days and nights she was more confused and excited; thought there were various animals and objects in bed with her; would sometimes strike at these and cry out angrily. Said that some animal had bitten her; she saw and heard people in the room; felt worms crawling on her body and saw them on the bed.

Temperature 99° to 101°. Heart very weak; pulse 130 and over.

March 22, 1893.—Denies hallucinations, but says when left alone she "imagines all sorts of foolish things"; picks at the bed-clothing, sometimes twitches all over, complains much of pain in her feet and legs which are very sensitive when handled.

March 27.—More pain in lower extremities; complains that some one is screwing her feet to the bed. She can flex the ankles very little and move the toes but feebly. Has foot-drop on both sides. She often starts out of a doze and twitches violently. There is coarse tremor of the arms. Patient is completely disoriented; mood happy—orders drink and talks to imaginary companions; mumbles unintelligible answers. Her attention can be held for a few moments only.

April 6.—Still completely lost; talks incoherently; mistakes people about her, and has no correct idea of time and place. She reaches for imaginary objects and goes through the motion of winding thread, tying knots, etc. Is placid and happy except when disturbed by pain; often whispers softly and laughs.

She is very helpless, cannot turn over or raise herself in bed. Pulse continues very rapid, usually about 140. She is troubled with a cough and has a bad diarrhoea.

May 19.—Patient fabulates freely—says she came here yesterday; was out for a walk to-day; has been out for a drive, etc. Physically she is better; digestion improved.

June 30.—Marked memory defect. Does not know whether she was here last week or not.

The mental symptoms gradually disappeared until in September it is noted that there only remains a difficulty in estimating the lapse of time. Steady gain in weight and strength, gradual disappearance of paralysis and pain in the legs; treatment—massage and Faradism.

For a long time after reaching a normal mental condition patient remained lame and had some pain and paraesthesia in the feet. At the end of one year from the date of her admission she had practically recovered, showing only a mild weakness of the extensor muscles of the legs and slight stiffness of gait. Normal mental condition. Good insight. Discharged recovered.

CASE No. 3.—Mother of last case. Admitted August 11, 1903. Age 49; married. Has been addicted to morphine and was said to have been moderately intemperate in the use of liquor. (This was afterward positively denied. There was no gastric derangement so the statement about abuse of liquor may have been erroneous.)

She is committed from a general hospital where she had been for two weeks, during which time she was hallucinated—saw animals, imagined her children were being murdered, said her husband had died and she wished to attend his funeral, said bats came from the ceiling and flew in her face, etc.

On Admission.—She is in poor physical condition, weight 100 pounds. Many scars from hypodermics on both arms. Temperature normal. Pulse 84. Heart and lungs negative. Tongue clean and steady. Pupils unequal, sluggish reaction to light; external strabismus of right eye; some drooping of both lids; vertical nystagmus in both eyes when looking upward. Gait unsteady, swaying. No Romberg. Knee-jerks normal. Complaint of pain in feet. Left foot and calf tender.

Mental Condition.—Patient was completely disoriented; thought she was in the postoffice in Toronto. She called the physicians and nurses by the names of people whom she had known previously. She spoke of her husband's funeral as going on. She had no recollection of being in the other hospital. She was drowsy and slept most of the first day.

On the following day she was more excited and restless; was annoyed by hallucinations of hearing—thought her children called

for help and that her brother had been killed. When directed to look at the blank wall or the bed clothes, she saw snakes and fish, a child, a woman's face, a yellow woman, a sideboard with imitation drawers, etc. Visual hallucinations elicited by light pressure on eyeballs also.

Hallucinations and confabulation persisted for three weeks, and during this time it is noted that "she can be recalled to a knowledge of her surroundings but her mind immediately wanders; she forgets in a few moments what is told her, never remembers the doctor's name though told daily. She fumbles with the sheet; says it is a white silk dress with a yellow spot. Mood sometimes cheerful but usually a depressed condition. Complains of pain in calves and feet, and numbness of fingers of right hand."

After one month she was clear. The memory defect had disappeared; she recalled her distressing hallucinations and delusions; had good insight. Convalescence was rapid and patient was discharged recovered after four months.

CASE NO. 4.—Woman. Admitted December 6, 1904. Age 46; married; no children.

Family History.—One brother died of tuberculosis and was insane for three months before his death. Another brother is a drunkard.

The patient has been drinking to excess for at least twelve years, and last summer she began to take morphine to make her sleep.

Present trouble began three weeks ago with delusions and confusion and complaint of "stomach trouble."

Statements in the commitment paper are: "She said she was out in the country having an awful time; that her husband was down the river; that she was cooking a turkey and going to a dance; that her mother and father (both dead) are here. She soliloquizes in a loud whisper and her face shows disturbance and anger. She gets out of bed at night and wanders around; sees crowds of people coming and going. Mistakes her surroundings. She is confused as to the day of week and time of day. Thinks each day is Sunday and that she has been to mass. Says she was at a funeral day before yesterday and worked at home all day yesterday (both statements untrue)."

On Admission.—The patient was completely disoriented in time and place and could give no account of recent occurrences. She made many contradictory statements, forgetting in a few moments what she had said before. She was emotional and occasionally wept.

Physical Examination.—Patient was in poor physical condition. Tongue and hands tremulous. Pupils unequal but with normal reaction to light and accommodation. Knee-jerks absent. Heart rapid and feeble. Pulse 120. No murmur. Slight bronchitis.

Since admission there has been gradual physical improvement, but a good deal of indigestion and much complaint of rheumatism (pains in legs). Knee-jerks still absent.

Patient is usually cheerful. She understands her present surroundings and has no hallucinations but many falsifications of memory. She will answer quickly and confidently but her statements are contradictory as at first. She continues to relate imaginary happenings of yesterday or last week, etc., forgets the doctor's name from day to day. Her mental condition four months after admission seems stationary.

CASE No. 5.—Woman. A dressmaker (U. S.) ; divorced ; age 38 ; mother of two children. Intemperate in habits.

Admitted June 18, 1901, with a history that she had had two previous attacks of mental excitement which were short in duration and maniacal in character, from both of which she recovered.

Present trouble began about three weeks before admission. It was characterized by a lack of interest in her surroundings and a restless, uneasy condition. She talked in a rambling, foolish way and made remarks something like the following: "I am determined to know why people are crazy and in the asylum. I am investigating their conditions." She said she heard beautiful music, the sound of flowers and the spray of water.

On Admission.—She was excited and in a playful mood ; she seemed to be elated and rather pompous in her conduct, but at times became irritable and made insulting remarks to the attendants and physicians. She imagined much of the time that she was travelling on a train or steamer. She remained in this half-maniacal condition until April, 1902, when she had a very severe cold and complained of much pain in her head. She was quite drowsy.

Following this she had very severe headaches with much vomiting, and in consequence lost 20 pounds. After a few weeks she was somewhat improved physically but mentally much worse, being more confused, restless, and talkative. Shortly after this she became quite delirious and remained so for a week, and later had a remission and seemed in about the condition she was on her admission.

In July, 1902, she became suddenly ill again. She vomited much and was unable to retain liquids at all, but could retain solid food to some extent. She again complained of great pain in her head and eyes, and continued to get worse until, in November, 1902, she was in a critical condition. Her pulse was very weak and irregular. She was very stuporous and could not be aroused. Pupils were unequal. She was constantly wet, not being able to retain urine at all. Bowels were constipated.

When she came out of the stupor and improved a little physically, she was very silly. Talked "baby talk"; mistook the identity of everybody, although occasionally she would address them by their correct names. She began to complain of queer sensations in her chest and knees. She said they felt cold and heavy, but there was no paralysis at that time.

She was able to be out of bed in December, 1902, but at this time she was unable to walk or lift her legs at all. She did not complain of pain in her legs but there was a "feeling of numbness" and she had areas of anæsthesia on the outer side of both legs. The knee-jerks were abolished.

In June, 1903, she was still unable to walk and there was considerable atrophy of the calf muscles. Mentally she was quite silly and childish, sometimes noisy, talking incessantly about events in her past life, some of which were real, but mostly fabrications; for instance, when asked where she was, she said: "This is the State House in Buffalo and Cleveland—the Half-Way House, they call it. When we made the Pan-American, it brought the two cities together—in art and in every way. . . . My father is living out West; has several villas. They are up from the valleys and so they are villas."

She could not tell the day. Says: "I am well taken care of. What do I care what day of the month it is?"

To questions, she will elaborate at great length about her child-

hood and youth, romancing about her having been an actress and that she is constantly travelling, imagining that she is on a steamer or taking part in all sorts of theatrical productions, etc.

She shows marked memory defect and cannot remember a number from one day to another, and when this is given her as a test she attempts to deceive the physician by scratching the number in the varnish of the wood-work so that she can refer to it when asked again.

At present she is able to walk a short distance, and shows no sensory disturbance. The knee-jerks are still abolished and there is a slight tenderness in the calf muscles.

The appearance of neuritis so long after admission to hospital is worthy of note.

In order to have a symptom complex assigned to the dignity of a disease entity, there are certain conditions which it seems should be met. First, there should be a fairly definite and constant etiology. Second, there should be a reasonably clear, definite, and distinct clinical picture, which does not (more than is usual in medicine), overlap or appear in other disease conditions. Third, the pathological findings should be fairly consistent, characteristic, and distinct. As to the etiology, a study of the cases, it seems to me, indicates that the condition is clearly a toxic one, of which poisons alcohol is by all odds the most constant and frequent. As regards the condition, it also seems that the picture of "Chronic delirium tremens," as it has been called, loss of memory especially for recent events, fabrications of memory, inability to retain impressions, loss of orientation, with evidences of an acute infection, mental confusion, and frequent appearance of polyneuritis, constitute a fairly consistent and distinct picture, though it is admitted that some of these manifestations are also seen in senile and general paralysis. As regards the pathology, I must quote briefly from some of the studies post mortem, made by pathologists. First, I am indebted to Dr. F. Robertson Sims, from whose article entitled "Anatomical Findings in Two Cases of Korsakoff's Symptom-Complex," appearing in the March Journal of Nervous and Mental Diseases (1905), I give the summaries of two cases:

First.—"Slight arteriosclerosis. Hypostatic pneumonia. Fatty

infiltration of the liver. Acute degenerations of many of the peripheral nerves. Axonal reaction in cells of the anterior horns, Clarke's columns, and many cranial nerve nuclei. Degenerations in the posterior columns, direct cerebellar tracts, and the root bundles. Moderate 'acute alteration' of the cortical cells."

Second.—"General arteriosclerosis involving the aorta and coronaries. Fatty degeneration of the heart, liver, and kidneys. Acute bronchitis. Acute degenerations in the peripheral nerves of the lower extremities, and also in the vagi. Axonal reaction in cells of the anterior cornua, in Clarke's columns, some cranial nuclei, and the Betz cells of the cortex.

"Vascular changes in the cord and cortex, with numerous microscopical hemorrhages throughout the cerebrum. Acute degeneration of the cortical radiations, and of both motor and sensory systems of the cord, as well as degenerations of the cord not easily reconcilable with the systemic changes."

I would make use also of some of the work of Dr. Cole who has given, in the article on "Brain" before referred to, a detailed account of the findings (post mortem) in three cases—one acute, two chronic. In the two chronic cases fibrosis of tibials is found, vascular changes of nerves, and in one vascular changes in the cord. Changes in the cells of the anterior cornua of the cord, and spinal ganglia; changes in the cells of the posterior cornua, Clarke's columns, in the direct cerebellar tracts, in the cells of the cranial nerves, in the pyramidal tracts, of the Betz cells of the cortex, and in the frontal thalamic fibers. The findings, as will be seen, were much like those in the cases reported by Dr. Sims. The one acute case showed acute degenerations of the nerves, not found in the others, but taking into consideration the difference in duration, the findings were fairly similar. Of course, the number of cases is small, but it is significant that there is such a correspondence in the lesions of these five cases.

In studying the fact that some lesions seem to be found in the peripheral nerves, and some in the central nervous system, Dr. Cole recognizes the difficulty of reconciling these differences, except on the theory that it is an entire neurone with its cells and fibers which are affected, and that in peripheral cases the disease, while a general one, may be manifested in the periphery of the nerve; as in arteriosclerosis senile gangrene may be a. manifes-

tation of the disease far removed from the centers of circulation, without evident changes between. The possibility of sites of selection on the part of toxins is also pointed out, and reference is made to such selective action as in the case of diphtheria where the poison seems to be manifest in the nerves presiding over deglutition and respiration, and in lead poisoning where the toxine seems to be by preference manifested in the nerves supplying the extensors of the wrists, and in alcohol where the poison, if manifested in a peripheral neuritis, is usually seen in wrist- and foot-drop. Also pointing out that the previous view, that alcoholic neuritis consists in an inflammatory infection of the nerves only, is now rarely held. That it consists in a degeneration of the nerve fibers in spite of complete, or nearly complete, absence of changes of the sheathes, connective tissues and vessels. That, in fact, there are fewer vascular interstitial changes, the more severe the changes in degeneration, thus showing that they cannot be the causes of the fiber degeneration. In other words, that fiber degeneration is the primary element of the neuritic process.

In an article by Dr. Turner, in the *Journal of Mental Science*, he quotes Chotzin as saying that women are more susceptible than men, and that the recovery ratio is as one to thirty-eight in both sexes. Soukenhoff and Boutenko found that in one hundred and ninety-two cases collected, one hundred and twelve were in men, and eighty in women, and that about seventy-five per cent were alcoholic in origin. In nine per cent, only, was multiple neuritis absent in the men. In about half of those not dying, mental defects persisted. Complete recovery was put down as occurring in about two per cent. In another series, fourteen women out of seventy-six recovered, or eighteen per cent, and twenty-one died, the rest showing more or less defect, and dementia persisting. Eleven out of fourteen recoveries were alcoholic cases. Of Turner's twelve cases, an analysis indicates that four recovered; three were discharged recovered, but with some memory defect; three were not considered recovered but persisted with more or less marked mental defect, and two died.

Our experience inclines us to believe that the low percentage (two) of recoveries given by some is, or will be found in a study of a larger number of cases, entirely too low, and that we may feel encouraged to hope for a favorable outcome in suitable cases.

Whether a disease entity or not, I believe the picture is a more or less clearly cut and recognizable one to those engaged in the actual practice of psychiatry, and my experience leads me to believe that in this, as in many other diseases, an encouraging measure of success is obtainable by persistent, constant, and intelligent care and treatment.

DISCUSSION.

DR. H. W. MILLER. Mr. President.—I wish to express my appreciation of Dr. Hurd's very timely and instructive article. We all understand how difficult it is for a busy superintendent who is overburdened with executive duties to prepare such a presentation as he has given us to-day.

I think this is an extremely interesting psychosis or symptom-complex. Whether it is a psychosis or whether it is a symptom-complex is debatable, but every careful clinician cannot fail to observe certain characteristic symptoms which strongly suggest a distinct clinical entity. Although it may be somewhat similar to senile dementia, as has been suggested, I do not think an acute observer would often be led astray. The ætiological factors, the characteristic disorientation, the memory disorder, the *Merkfähigkeit* defect, the romancing, etc., with the frequent association of neuritic disturbance, make to my mind an impressive picture.

I think it is well to be a little cautious, and I would rather prefer to apply the name Korsakoff's syndrome or Korsakoff's symptom-complex, because in outlining and designating a clinical entity we have to take into consideration the ætiology, the course, the outcome, and the pathologico-anatomical changes.

Considering the ætiological factors of these cases we find that excessive alcoholism is predominant in the majority. In some cases it is morphine, in some tuberculosis; in one of my cases it was a post-typhoid condition. Thus we find in the great majority of the cases a toxin either formed without or produced within the organism, or we have the combination of both. We perhaps unfortunately, find this symptom-complex produced by brain injury, which fact Kalberlah recently reported in an article (Korsakoff's symptom-complex after brain concussion). He also carefully reviewed the literature on this subject.

Of the pathological changes in this condition there is considerable discussion. It is claimed by some that there is always what is known as central neuritis with the concomitant changes. Again we find nothing but the axonal reaction in the spinal cord without significant changes in the cortex.

The close association with poliomyelitis superior hemorrhagica, in so far as anatomical changes are concerned and even from a symptomological standpoint has led many to consider it part of the same process. Thus we find certain differences of opinion as to the pathological changes.

Now considering the course and outcome, the majority and the consensus of opinion is that the condition leads to an irreparable mental

defect, which in some cases is very slight. Dr. Hurd is rather more hopeful of it than I am with my limited experience. I cannot recall a permanent recovery in any of my cases.

Now we may ask the question, are all these apparent discrepancies sufficient to invalidate our conception of this process as a disease? Is it not possible that there is a common cause underlying the whole disease, and can this common cause produce all the symptoms and the anatomical changes which have been described? It is to be hoped that future study will elucidate these apparent discrepancies.

Bonhoeffer calls the condition chronic alcoholic delirium, but he does admit that it may be caused by other toxins than alcohol. Korsakoff gives a whole series of ætiologies, but there is no doubt that alcohol is by far the most important ætiological factor. We see it is present in every case of Dr. Hurd's but one. Of the four cases which I reported, three were alcoholic, and of the six cases which I have had in my service since that report, every one was alcoholic. I might add that of my reported cases two are still in the hospital and show practically no change; one has gone home and is earning a living, but could not, even for statistical purposes, be considered a recovery. He is emotional and has a very defective memory.

The question of association with peripheral neuritis has been well discussed by Dr. Hurd, and I do not consider that it is of fundamental importance whether the toxic effect is concentrated upon the peripheral or upon the central neurones, or upon both.

I came prepared to discuss the pathology of the disease, but I find that my time is up, so I will not further burden you. I wish again to thank Dr. Hurd for his very interesting reports.