A CASE OF MOTOR DYSPRAXIA AND PARAPHASIA: AUTOPSY: TUMOUR IN SUPRAMARGINAL CONVOLUTION.

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ALTHOUGH the manifestations which are included under the term motor dyspraxia are found not infrequently in cases of hemiplegia, aphasia and other cerebral disorders, the number of cases which have been fully investigated both clinically and pathologically is still small. Moreover, in the majority of cases which have been reported in the literature motor dyspraxia has been one only of a series of manifestations, and at necropsy multiple lesions have usually been found. In the patient who forms the subject of this note the clinical interferences were limited to motor dyspraxia, dysgraphia, paraphasia, and amnesic aphasia, and at autopsy a small, well localized, secondary carcinomatous nodule in the left supramarginal convolution surrounded by recent cerebral softening was found. The case, although incomplete from a pathological point of view owing to the fact that a detailed microscopic investigation of the fibres destroyed by the tumour was impossible, seems to be one of considerable importance for the localization of these interferences in the cerebral hemispheres.

Wilson [6] defines *motor dyspraxia* as "the difficulty in performing certain subjectively purposive movements, or movement complexes, with conservation of motility, of sensation, and of co-ordination." Liepmann [3] terms the difficulty in finding words *amnesic aphasia*, and gives the name *paraphasia* to the difficulty with speech characterized by "omissions, duplications, perseveration to earlier syllables, anticipation of later syllables, sliding off into words related in sound and sense, fusion of parts of suitable words with those of similar sound and similar sense, and loss of sequence in words owing to the action of accidental sensory impressions."

Whilst under observation from a clinical point of view the patient was for twenty-one days a satisfactory subject, and during this time

his condition altered little. Twenty-four days before death, however, weakness of the left half of the body and hebetude appeared, probably owing to the development of cerebral softening around the tumour.

At the International Congress of Medicine in London in 1913, Liepmann [3] said, "the region which is by far the most frequently affected in well developed apraxia is the left parietal region. This I have proved by a study of twenty-six cases of my own and of the whole of the literature on apraxia. Indeed there are sufficient cases of apraxia in which only lesions of the parietal lobes have been found." Kleist [1] in 1911 analysed the findings at necropsy in twelve recorded cases of ideo-kinetic dyspraxia, such as this patient exhibited, and found that in all lesions of the supramarginal convolution had been present; in eight of these other lesions also existed. In a case reported by Strohmayr [5] in 1903 severe motor dyspraxia affecting all four extremities, paraphasia, loss of initiative, and considerable difficulty with reading and writing were associated, and at autopsy a cyst 5 cm. in diameter was found in the left supramarginal convolution. Isolated lesions of vascular origin were also found in this region in two cases reported by Kroll [2] in 1910 and in one reported by von Stauffenberg [4] in 1911. These four cases all showed clinically severe motor dyspraxia of all the extremities and both halves of the trunk, difficulty with reading, inability to copy, difficulty in writing to dictation, paraphasia, and considerable loss of memory; and at autopsy cyst formation or cerebral softening consequent on interferences with the blood supply of the supramarginal region on the left side was found in each. Von Stauffenberg [4] sums up his conclusions "lesions of the lower portions of the parietal lobe which do not involve either the angular gyrus or first temporal convolution, but affect the subcortex almost down to the lateral ventricle, regularly give rise to apraxia and an interference with the mechanism of speech, characterized by paraphasia and gross interferences with reading and writing but do not affect the understanding of speech." The findings at autopsy in my case confirm his statement that "disease localized to the supramarginal convolution on the left side can cause apraxia." Nowhere in the literature, however, have I been able to find any record of a case where a well localized neoplasm, either primary or secondary, has given rise to motor dyspraxia and paraphasia.

In this case it is also noteworthy that, although from the appearance of slight proptosis, paralysis of the external rectus and paresis of the internal rectus muscles, and the distortion of the outlines of the sella turcica as seen in the radiogram, the presence of secondary carcinoma

in the region of the pituitary gland was diagnosed during life and its presence confirmed at *post-mortem* examination, no signs of super-pituitarism or subpituitarism were present; yet, as seen in the microscopical specimens, practically the whole of the three lobes of the pituitary gland were infiltrated by growth and little normal glandular tissue could be discovered.

Sidney T., married, engineer's fitter, aged 41, was admitted to the London Hospital under the care of Dr. Lewis Smith, on August 17, 1914, and died on September 29.

Between 1903, when he married, and 1913 his health was uniformly good. About February, 1914, he began to complain to his wife that his habitual skill with his tools was failing; he became depressed and irritable, but his health remained fair until June, 1914. During the last week of that month his left wrist swelled, and the skin over it became red, shiny, and tender. He saw his local doctor, who diagnosed gout and kept him from work for seven days. Three days after his return to work he developed a left-sided headache. The headache was severe, persistent, and kept him awake at night time; in bed he was restless and tossed about. On July 10 he began to "see double"; he then attended at an Eye Hospital, where he was found to have paralysis of the left sixth cranial nerve and a certain amount of proptosis on that side. During the month of July, speech was not affected, memory was good, and yet he "thought he was going out of his senses," and became more irritable and more depressed. About 10.30 p.m. on August 3, he had a seizure; "for a minute or so he went stiff, his eyes rolled, he became black in the face and foamed at the mouth." After the seizure he complained that his headache had increased, he tossed about but only partially roused. Half an hour later, about 11 p.m., he had a second similar attack lasting a minute or so. He then remained unconscious until 12.45 a.m. on the 4th, when he suffered from a third similar, but more severe, attack in which he passed water. For the next eight hours he lay drowsy or asleep, and did not know where he was. On August 4 the pains in his head were extremely severe, diplopia had become more troublesome and speech had altered. He was kept in bed from the 4th until the 9th, and gradually, despite the pains in his head, "seemed to become his old self again."

During the week, August 10 to 17, he gradually "went downhill." His memory failed and "he would wander and lose his words, although his mind was otherwise clear." His wife said that he seemed to be unable to recognize that he was only addressing her as soon as he began to talk about other people's affairs; "when talking at home to me alone, he would speak of my wife Annie just as if he were in company." On the 10th, for instance, he was talking to his wife about the affairs of his brother-in-law, when he suddenly remarked "now my wife Annie cannot help me"; on the same day he was found gazing into a cupboard, and when his wife asked him what he was doing he remarked "I don't know why I look in there, I must be mad."

On the 16th he lay in bed all day complaining of intense pain in the left side of his head.

He denied all venereal infection, and the Wassermann reaction both in the serum and cerebrospinal fluid was negative. At the age of 17 he had suffered from diphtheria. His wife, who was alive and well, had had two children, born in 1904 and 1907, who survived and were healthy.

The patient was a well developed, pale, thinly covered, right-handed man of 41, showing signs of recent wasting. On admission the temperature tended to be slightly irregular and varied from 97° to 99° F. The apex beat of the heart was felt in the fifth space just inside the midclavicular line. The area of cardiac dulness was not increased, there was no cardiac displacement, and the heart sounds were clear. The wall of the radial artery was just palpable, but the tension was not raised. The rate of the pulse varied from 60 to 80 beats per minute. The liver and spleen could not be felt and to percussion were not enlarged. The quantity of urine passed in twenty-four hours varied from 28 oz. to 56 oz.; albumin and sugar were never present. The lymphatic glands above the clavicles and in the axillæ and groins were not enlarged. The fingers were slightly clubbed.

For some days before his admission he had complained of a dry, hacking cough, but had not expectorated. The chest was symmetrically developed, but moved badly in its upper half on the left side. The movements of the lower portions of the chest on the two sides were equal. Tactile vocal fremitus and vocal resonance were unaffected. In front, the percussion note was impaired in the second, third and fourth interspaces on the left side, but was almost normal in the supraclavicular fossa; behind, the note was flat over the upper part of the infraspinous fossa and between the second and fifth thoracic spines and the vertebral border of the scapula, and was impaired over the whole of the upper lobe on the left side. The breath sounds over this lobe were weaker than over the corresponding areas on the right side, and from time to time fine or medium crepitations were heard there. A radiological examination of the chest at this time showed an opacity of almost uniform density of the whole of the upper part of the left side, with displacement of the trachea to the right, but no displacement of the heart. A radiographic plate in addition gave evidence of some consolidation in the region of the root of the lungs. The rate of respiration varied from 20 to 26 per minute.

The knee-jerks were equal and readily obtained. The ankle-jerks were normal, there was no ankle-clonus, and both plantar reflexes gave a flexor response. The wrist- and elbow-jerks were unaffected, and the jaw-jerk was obtained. The abdominal reflexes could be elicited, but were sluggish. The ocular and pharyngeal reflexes were normal. The sphincters were under control, and the movements of the spine were unaffected.

To sensory testing no loss of sensibility was discovered. The light touches of cotton-wool were everywhere appreciated, and could be localized. The pricks of a pin and the tests with hot and cold tubes at varying temperatures elicited accurate replies. The vibrations of a large tuning-fork ($C = 128$) were

well recognized on all four extremities, and the duration of their recognition was nowhere shortened. Recognition of posture and passive movement was unaffected, and without much effort he could identify and give the properties of objects placed in his hands. There was no falling away of the outstretched upper extremities on closure of the eyes.

In the extremities and trunk there was no local muscular wasting, and no change in muscular tone. Movements of normal range and power were possible at all joints, and the patient did not complain of spontaneous twitchings, and showed no other involuntary movements. Gait was little affected, and Romberg's sign was not obtained. The grasps of the hands were powerful and equal.

He complained much of diplopia. Movements of the right eye were well carried out. The left eye was turned inwards. With this eye he experienced considerable difficulty in looking inwards to the right, and was completely unable to look outwards to the left. The left eyeball was more prominent than the right, but there was no ptosis of the upper eyelid, and nystagmus was not present. The pupils were equal, and reacted briskly to light and to accommodation. Facial movements were normal, and the movements of the palate and larynx were unaffected. The trapezii and sternomastoid muscles acted normally, and he suffered from no difficulty in swallowing. The tongue was protruded straight, and could be held steadily.

Smell, taste, and hearing were unaffected. Vision for form, colour, &c., with both eyes was normal, and the visual fields for white and colours were not diminished. On the left side the vessels of the ocular fundus were full and tortuous, and the lamina cribrosa could not be distinguished; on the right the vessels were full, the edges of the disc blurred, and the lamina cribrosa filled. The swelling of the disc, however, measured less than 1 D.

He constantly complained of pains in the frontal region, and said that they were always worse on the left side than on the right. When asked where the pains were situated, he put his left hand over the left orbital and temporal region, and swept it round over the malar bone towards the left ear. He said that the scalp here was tender, and pressure over the left orbit and temple elicited a complaint of "pain." The pains were usually worst in the early morning and after sleep, but were constantly present. He never complained of pain in the occipital region. He said that the pains in his head made him feel sick, but whilst under observation never vomited. On August 3, 1914, he had suffered from three epileptiform attacks; after this date until death he was free from seizures.

He was attentive and, except when the pains in his head were severe, took considerable interest in the happenings of the ward; he was, however, never interested in his fellow patients. He was extremely grateful for the trouble taken in the investigation of his case, and willingly undertook every test. When his headache was severe, he lay drowsy and inattentive, but when addressed would always rouse himself and attempt to answer questions.

Throughout his stay in hospital memory seemed to vary; on some

occasions he could recall events and give details of his illness, work, and past life; on others all efforts of memory seemed impossible. At times he would describe spontaneously the recent events which had happened around him, and on these occasions gave evidence that he could retain recent impressions.

In space and time he was well orientated; he knew the day, hour, and manner of his arrival at hospital, admission, and of the various examinations. In general he was cheerful, but was easily moved to laughter or tears; when the pains in his head were severe, he was irritable, suspicious, and depressed. Except in the matter of words he was not very subject to suggestion. The last phrase of a sentence seemed frequently to be dominant, and he would often repeat several times the last few words made in answer to a question, even though he was not further addressed.

Judgment and the power of reasoning seemed little impaired, despite his difficulty in expressing himself. He associated ideas readily and could appreciate humorous episodes and the point of a story. He was not subject to hallucinations, and never suffered from delusions. He did not complain of worrying dreams or nightmares. He slept well, and, for the greater portion of the twenty-four hours, when left to himself, lay drowsy or asleep.

In eating and dressing himself he was careless, but became annoyed when he dropped food or otherwise dirtied his bed.

He rarely moved from his position in bed, and, except when directly addressed, rarely spoke. Individual words were well pronounced. He could put together spontaneously short reasonable sentences; in each sentence, however, some words were always badly articulated and slurred. Phonation was monotonous. In attempting to give an account of himself such remarks as: "Last Easter, that was in nineteen, let me see, let me see, fourteen, last Easter, last Easter, to the best of my recollection, as far as I can remember, I went to Easter, to Easter, to Lower Edmonton. There lives my wife and my wife's, yes, my wife's, my wife's sister; he is a cabinet maker at Easter, at Easter" . . . were constantly heard.

He signed his name with great satisfaction; the signature, however, was somewhat illegible and tremulous. In writing his address he misspelt words and, after looking at what he had written, rewrote some of the words which he had spelt wrongly or attempted to polish up the letters. To dictation he wrote single words of several syllables correctly, but was unable to take down correctly a sentence containing more than about five words. After writing a complex sentence he would look at the result, and, becoming dissatisfied, frequently crossed out all that he had written, saying "No, that's not right; I can't do it, I'm losing my senses." In writing to dictation perseveration frequently occurred; for example, he wrote "The London hospital hoptal is the the largst largest larst hostal in London."

He enjoyed reading the newspaper to himself, but easily tired. After reading for four or five minutes he would throw the paper aside to take it up again a few minutes later. He seemed to understand what he had read and would attempt in broken phraseology to retail the occurrences of the War, of which he

had just been reading. When asked to read aloud he managed simple words and sentences fairly well, and understood what he had read; long names and unusual words, however, were bungled and incompletely articulated. Frequently too, he mixed up words from different lines of print, making the whole seem an unintelligible muddle.

After considerable hesitation he copied slowly written manuscript with a fair degree of accuracy, but when copying printed matter he made more frequent errors.

He repeated the alphabet without mistake, and could count readily up to a thousand. He knew all the multiplication tables. He found difficulty in calculating. In attempting to deduce his age from the date of his birth he said: "Let me see, I was born in seventy, seventy, seventy-three, yes, that would be eighteen seventy-three when I was born, so that my age, my age, must be. No, I can't do it, I'm sorry, I can't." When asked immediately after this the age of his child born in 1904, he answered without delay "seventy-three," then he paused a moment and said "I have two children, a boy and a girl, I will give you their ages in a minute, let me see, let me see, no I can't do it, no, no," but never found the answer. When asked if one is not 10 years old, he nodded affirmatively and said "Yes, that's right." The question, How old is your wife? was then asked. "My wife will be ten years old in November; no, that's wrong, my wife will be, will be, eleven years old come June" (his wife was born in June, 1874), "oh, dear, oh dear, I think I'm mad."

In answer to the query, How many are nine times eight? he said: "Let me see 3×8 are 24, 4×8 are 32, 5×8 are 40, 6×8 are 48, 7×8 are 56, 8×8 are 64, and 9×8 are 72; yes nine times eight are seventy-two."

On again being asked, How many are nine times eight? he again repeated the eight times table and arrived at the answer seventy-two. On being asked a third time, he recognized that the question was the same, and remarked, "How foolish, how foolish!" and again repeated the table and found the correct answer. For a few minutes then no words were spoken and he was heard to repeat under his breath, the eight times table through, completely twice, as far as nine times eight. He was then asked, How many are eight times nine? To this he answered, "Eight times nine are the same as nine times eight, but I can't remember how many that made."

Without paper he was able to add eight to twenty-seven and readily answered thirty-five, but when asked to add three hundred and twenty-seven and eighteen, he said "That's more difficult, let me see, eight and seven are, no, let me see, oh I can't do it, no, give me the paper," whereupon he wrote "327"

¹⁸ and then said "No, it's too hard," and gave up the attempt. He subtracted in his head eight from twenty-seven and gave the answer nineteen, but when given paper and having written down ^{"327"}
18 could not do the subtraction.

When objects were held in front of him, he preferred to take them in his left hand, but when his attention was directed to his right hand he would take them in this. He could imitate, with either hand or with both, movements made in front of him; but when attempting to carry out a movement with his right hand, the left often moved correspondingly, and frequently he would repeat the movement he had just finished before he attempted to carry out the new movement which he wished to imitate.

To command he could snap his fingers, whistle, make pill-rolling movements, shake his head, nod, laugh, look angry, groan, cough, touch his nose, put out his tongue, show his teeth, take a deep breath, &c. He could also make any movement of expression, beckon, salute, throw a kiss, clasp his hands, make a fist, prepare for fight, &c.

On request he could make simple movements for definite objects without having the object in his hand. He showed well how to knock at a door, count out money, draw a cork, turn a barrel organ, strike a match, with either hand, but in all these actions the movements performed with the left hand were better executed than those with the right; when using the right hand, more joints of the limb and frequently the whole of that half of the body partook.

With more complex orders the results were always less well performed than with simple orders. For instance, when told to put his left hand on his head, the movement was well carried out; but when told to put his left hand on his right ear, he first put his left hand to his left ear, and then put his right hand on his right ear; recognizing, however, that he had not done what he intended, he shook his head, looked around for a moment when a gleam lighted his face and he put his right hand to his right ear and his left hand to his left ear. He was then told to put his left forefinger on his nose, whereupon he put his left hand on his left ear and then placed his right forefinger on the bridge of his nose. At the question, *Is that right?* he put his left forefinger on to his nose, and then quickly put his right hand to his right ear saying, "Now that's it, isn't it?"

On being asked next to make a fist with the left hand, he made a fist with both hands. He was then told to open his left hand, whereupon he opened his left hand, then half closed it, opened his right hand, half closed this, and finally opened both hands.

When asked to make movements as of cutting out with scissors, he made with both hands irregular movements for clumsily using scissors; a moment later, after gazing at his hands, he stopped the movements with his left hand whilst continuing those with the right.

He was able to make any simple movements on request; he touched his ear, scratched the middle of his back, pulled his hair, touched his great toe, tickled himself on command. He was equally certain when asked to touch similar parts of the observer's body. With objects in his hands he could brush his nails, comb his hair, blow his nose, &c. When given a paper knife and asked to show how this should be used, he folded the bed-clothes and then flourished the knife as if it were a butcher's. When asked to indicate

the use of a pencil he wrote his name on paper; and when given a pair of scissors and asked to show how they should be used, he took them in his right hand and began to perform cutting movements clumsily, but, becoming dissatisfied, asked for a piece of paper saying, "I can't use these things without a something to cut."

When asked to show how to thread a needle, no needle being given, he carried out the necessary movements more successfully than when he actually held the needle and thread. When shown a key, and asked to indicate how this should be used, he went through the movements of inserting the key and unlocking a door in a more or less complete fashion. He was then given a closed padlock and key, and asked to use the key, whereupon, holding the lock in his right hand he fumbled with the key; eventually he succeeded in inserting the key into the hole, but even then was unable to unfasten the lock. When given a comb, and asked to show how it should be used, he clasped the comb tightly in the palm of his right hand, passed it into the palm of his left, worked it up to his fingers and immediately started to comb his hair by moving his head against the comb.

A lighted match was placed between the fingers and thumb of his right hand; as the match burnt he skilfully worked it up his fingers, and when nearly burnt blew out the flame.

When given a box of matches and a pipe loaded with tobacco, he placed the pipe in his mouth, held the box of matches clumsily in his right palm, opened the box with his left hand, took out three matches, discarded two of these, closed the box and then made several attempts to strike the box on the match; after several such movements the match lighted, whereupon he dropped the match box, transferred the lighted match to his right hand and carried it to his pipe, but in puffing at the pipe blew out the light. He then repeated the performance but could not light the pipe. After two attempts he remarked, "No, no, I can't do it, though I should like a smoke." When given the match already lighted he succeeded in lighting his pipe at the first attempt, and when asked to strike a match he did so readily.

When given a piece of string, and asked to tie a knot on it, he held the string tightly between the clenched fingers and palm of his left hand and attempted with his right hand to throw a loop and catch the string with his left index finger. In this manœuvre he made many attempts, but in each failed; eventually after trying five minutes he gave up, saying, "I know how to do it, I've tied so many in my time, I've been in so many kinds of business and in all I had to tie knots, but, you know, all my skill for such things has gone. Almost everything with my fingers I've lost most." At the same time he could distinguish and name most types of knots, e.g., sailor's, granny, reef, &c.

When given five pennies and a halfpenny and asked to count the money, he placed the coins in his left palm and, touching the pennies in turn with his right index finger, counted "One, two, three, four, five, five pence halfpenny, that's right, isn't it?" On being given two florins, a shilling and sixpence

he counted the money from his left hand into his right remarking, "Two, and two, and one, that is four, and three, and six, no, no, that is four and sixpence, that is five and sixpence, yes, yes, that is five and sixpence. I know that, that (the florin) is two shillings, and that, that is twice that (the shilling) and that is a sixpence." Given gold, silver and copper to the value of £3 4s. 11½d., he made several attempts to count it out, but could not give any result; when eventually told the amount he remarked, "Yes, yes, I know how much it is, you can't do me! but I can't tell you."

Five plates were placed on a table in front of the patient, and were audibly and slowly numbered 1, 2, 3, 4, 5, the exact plate being indicated with the finger as the number was called; on the table to the right of the plates were placed a penny, a sixpence, a florin, a half-crown, and a sovereign. He was then asked—

To put the sixpence on plate 5.	Performed.
To put the sovereign on plate 1.	At this he put the sovereign on plate 5, waited a moment, and then took it out and placed it on plate 1.
To put the half-crown on plate 1.	Performed.
To put the florin on plate 4.	Whereupon he put the florin on plate 1; when asked if this was right, he took sovereign from plate 1 and placed it on plate 4.

When the test was made more complicated he usually paused and carried out a part of the command; on other occasions he would not attempt to perform any of the movements, although apparently he had understood, for he would remark, "I know what you say, and what I would like to do, but my hands seem all wrong." With practice on any one day the results obtained with this mode of testing became more and more accurate, provided that the orders were not made too complex, but on different days the accuracy of the results varied greatly. More accurate results were always obtained if the number given to the plates in front of him was written on them, provided that the numbers ran consecutively; if, on the other hand, the numbers on the plates were in the order, say, 5, 3, 4, 1, 2, the patient rarely succeeded in placing three of the coins consecutively on the desired plate.

When shown objects and asked to name them, he said when shown—

A pin.	(Readily) "pin."
A needle.	(Pause) "pin."
A pencil.	(Longer pause) "pin."
A watch.	"Half-past nine" (correct).
Yes, but what is it?	"Timé pièce."
Watch pocket in vest.	"Vest pocket."
The watch again.	(Readily) "vest-pocket holder"; he then became angry, shook his head and began to weep.

A medicine bottle.
 What does it contain?
 A bunch of grapes.

"Bottle."
 "My medicine."
 (Long pause and then) "rubber balls."
 After eating one he remarked, "I was driven to say rubber balls, oh, I know what they are; they are rubber balls and very good at that: yes, yes, very good rubber balls."

But they are not made of india-rubber, are they?

"I know that well enough, but words won't come, I can't think what they are."

On being told that they were grapes his face beamed, he nodded and said—

"And very nice, too."

A piece of string.
 An electric light bulb.

"String."
 "Electric light bulb; yes, we make those at our works." (Words badly articulated.)

A nail-brush.

"Oval brush"; then he began to show how it should be used; as soon as the brush touched his finger nails, he remarked, "no, a nail-brush."

The watch again.
 A towel.

(Readily) "time piece."
 (Pause, ten seconds) "towel," and then he read off the stamp, "London Hospital, Charrington Ward."

An inkstand.
 A pocket-knife.
 A fountain pen.
 A pencil.
 A pin.

(Quickly) "inkstand."
 "Knife, yes, pocket-knife."
 "Penholder."
 (Pause) "pen, no, fountain pin."
 (Instantly) "pin."

When a pin was placed in his right hand and a needle was put into his left, and he was asked, What is the difference between a pin and a needle? he remarked "The two extremities of the one are sharp, the pin is sharp, one end is sharp, the other end is sharp, is blunt." The needle was then removed from his left hand, leaving the pin in his right, whereupon, pointing to the blunt end of the pin, he said, "Now that end is both sharp, one end I can put through it, it has got a sharp extremity, the other"—continuing to fumble with the pin—"now that end is both sharp, let me see, let me see, I know, no, I'm sorry, but I can't tell you." Given the needle into his left hand, whilst the observer held up the pin in front of him, he said, "That's better!" pointing to the point of the pin with his right hand, "That's a plain point," and pointing to the head of the pin, "That's dull and has no point at all." Then examining the needle in his left hand and pointing to the eye of the needle, "That has got a needle and a cotton goes through it, a needle has a

cotton to it." He was then given the pin and a length of cotton thread, whereupon he spent two minutes vainly attempting to pass the thread through the head of the pin, fumbling in a clumsy fashion and occasionally putting his left hand to his head as if in thought. At the end of this time he remarked, "No, no, let me see, let me see." On being given the needle and the thread, he said, "Now we're off," and spent two minutes more in vainly attempting to thread the needle, eventually giving up the attempt, saying: "My right hand is a fool, I can't use it at all."

The number of times the patient repeated any given action bore little or no relation to the accuracy of the performance of that action. Moreover, no improvement in the mode of carrying out the action could be obtained after showing him how to use objects placed in his hands. A movement once initiated, either voluntarily or in response to a command, could be continued after the closure of his eyes. Even with his eyes closed he was able to place his right upper extremity into any position into which his left had been placed either actively or passively. No differences between the accuracy of imitation of postures from right to left and from left to right could be determined. The hands partook normally in general movements of the body.

His ideas of objects seemed to be normal; he had knowledge of the desired results of actions which he wished to perform, of the parts of the body which he would have to move, and of the order of their movement in order to accomplish the desired action.

The general condition of the patient altered little during the first three weeks after his admission, but the interferences with speech, with the performance of purposive movements, and with memory varied considerably from day to day and from moment to moment. When the pains in his head were severe, his memory was less certain, and his ability in carrying out movements with objects and on command diminished. From examination to examination and during each examination the results obtained in answer to tests varied greatly, although the type of intellectual loss remained constant; the variations observed seemed to be determined by the amount of attention the patient was able to concentrate on the required thought or action; at times little or no loss appeared, at others the loss was great.

No actual loss of power and no definite paresis of any kind was discovered until September 5. On the night of the 4th to 5th the power in his left upper extremity diminished to such an extent that the grip on this side, measured on the dynamometer scale, fell in twenty-four hours from 80 to 30, whilst that of the right hand remained unchanged between 70 and 80. After this date he became more drowsy and heavy, and to testing less certain in his answers; at the same time the headache became more constant and more severe.

A radiographic negative of the skull taken on September 3 shows a loss of definition of the upper margins of the sella turcica, but no changes in the outlines of its floor or elsewhere in the skull, and no alteration in the density of the soft tissues of the cranium.

Gradually the weakness of the left upper extremity, first noticed on September 5, extended. On September 24 the patient was characteristically hemiplegic. The muscles of the left forearm and hand were absolutely flaccid and the patient was unable to move this extremity. He could not lift his left leg from the bed, but was just able to flex the knee and dorsiflex the ankle. The left leg was somewhat hypertonic and stiff. On the left side the knee-jerk and ankle-jerk, and to a less extent the deep reflexes of the arm, were exaggerated; ankle-clonus could not be obtained, but *both* plantar reflexes gave an extensor response. He could no longer control his sphincters.

Under observation the signs of disease in the chest gradually extended and before death affected the whole of the left lung; at the same time catarrhal signs appeared in the right lung. On September 22 the temperature became raised and irregular, and the rate of the pulse rose to 120 beats per minute; on the 28th the temperature reached 104° F., the pulse was uncountable at the wrist and the rate of respiration was 50 per minute. On the morning of the 29th, forty-four days after admission and eighty days after the onset of the squint, he died. An autopsy was performed on October 1.

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Occupying the lower and posterior half of the lower lobe of the left lung was an ill-defined mass of carcinoma, measuring 6 cm. in diameter; the apex of the lower lobe also showed carcinomatous infiltration. A small secondary carcinomatous nodule was found in the centre of the lower lobe of the right lung. Secondary nodules of carcinoma, up to 3 cm. in diameter, were present in the glands at the hilum of the left lung and at the bifurcation of the

trachea; at the hilum of the right lung smaller secondaries were seen. The left lower paratracheal glands contained masses of secondary growth 2 cm. in diameter, and the right a mass measuring 4 by 2.5 cm., which was continuous with another mass, 7 by 4 cm., in the superior mediastinum. The left pulmonary vessels were constricted by these secondary glands. The lower end of the trachea and the commencement of the left bronchus were infiltrated by carcinoma, which had spread from the paratracheal glands. Masses of secondary carcinoma were also found in the right and left lower cervical glands, in the glands of the lower portion of the mediastinum and in the pancreatic glands. A secondary nodule measuring 6 by 5 cm. was found in the right suprarenal gland and a similar mass, 3 by 3.5 cm., was found in the left.

The brain weighed 1,439 gm. The meninges appeared normal. All the convolutions were flattened. The left supramarginal convolution contained a nodule of secondary carcinoma 2.5 cm. in diameter. This nodule was slightly adherent to the meninges, had a rounded form, and extended deeply into the subcortex. It was surrounded on its upper and anterior border by recent anæmic softening. The lower half of the post-central convolution was diffuent. The superior temporal, the angular, the upper part of the post-central, and the superior parietal gyri were unaffected, and no gross changes were seen in the other convolutions of the hemispheres. In macroscopical section the corpus callosum, the tapetum, and the inferior longitudinal bundle appeared normal.

The whole of the pituitary gland and the meninges around it were infiltrated with carcinomatous growth, which had eroded the floor of the sella turcica, and invaded, as a mass the size of a marble, the sphenoidal fissure.

In the medulla of the right femur, at the junction of its middle and lower thirds, an osteoplastic secondary nodule of carcinoma 1.3 cm. in diameter was discovered.

The upper part of the upper lobe of the left lung was collapsed and cedematous, whilst the lower lobe on the right side showed bronchopneumonic consolidation and mucopurulent bronchitis. Over both lungs a certain amount of serofibrinous pleurisy was discovered. The heart appeared normal; the liver and kidneys were congested, and the spleen was slightly enlarged and septic (weight 241 gm.).

Microscopic Examination.—Portions of (1) the left lung, (2) a lower cervical gland, (3) the left suprarenal, (4) the pituitary gland, and (5) the nodule in the left supramarginal convolution of the brain were embedded in paraffin; sections were stained by hæmatoxylin-eosin and van Gieson. The carcinoma is similar in appearance in all sections. It consists of tubules lined by columnar, cubical or polygonal cells, and less numerous, solid processes composed of polygonal cells. A little secretion is present in some tubules. There are areas of necrosis, which are infiltrated with numerous neutrophile leucocytes.

The pituitary gland is replaced by growth, with the exception of a narrow semilunar portion of the anterior lobe; in this remnant of the anterior lobe there are patches of necrosis.

The section of the brain includes half the rounded carcinomatous nodule and the convolution anterior thereto. The upper surface of the growth reaches the leptomeninges. The growth is confined to the supramarginal convolution; it is separated from the adjacent post-central convolution, in its upper part by a narrow strip of degenerate cortex, in its lower part only by leptomeninges in the intervening sulcus. The post-central convolution is cedematous, and many of its nerve-cells show considerable evidence of degeneration, for instance loss of angularity. The cortex opposite the lower part of the growth shows severe degeneration. In the anterior convolution there are no fat-granule cells.

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