WIGHTMAN PRIZE COMPETITION.

Six Cases
Entered by
J. M. Alston.

Case I. Myotonia (Thomsen's Disease).
Case II. Tic Involving the Eyelids.
Case III. Traumatic Lesion of Cauda Equina.
Case IV. Diabetes Mellitus.
Case V. Polyuria following Injury to the Head.
Case VI. Exophthalmic Goitre.

June 1934.
WIGHTMAN PRIZE COMPETITION.

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Case I. Myotonia (Thomsen's Disease).

June 1924.
NAME: WILLIAM BARCLAY WILSON.

ADDRESS: 17, MAVISBANK GARDENS, BELLSHILL, LANARK.

AGE: 11½ years.

OCCUPATION: Schoolboy.

PLACE OF BIRTH: Bellshill.

DATE OF ADMISSION: 17th October 1923.

DATE OF EXAMINATION: 24th October 1923.

COMPLAINTS:

(1). "Dragging" of legs.

(2). On sneezing, the eyes close and are difficult to open again.

(3). Something wrong with the hands. (Patient can't describe what is wrong without prompting).

DURATION: About 5 years - according to patient's statement, but his mother states that she first noticed the dragging of the legs 7 or 8 years ago.

HISTORY:

Personal.

Patient's mother states that the first of the series of symptoms now complained of was noticed when patient was 3 or 4 years old when patient walked with rather difficult and dragging movements of the legs. Before this time he had walked well and he began to walk at about 10½ months. The mother says that since this stiffness has begun patient is easily knocked down.

Patient can remember that for the last 4 years when he starts to walk from any resting position, lying, sitting or standing, his legs are stiff and he must practise bending his knees (for about 2 minutes he says) before he can walk. The bending movements are very slight at first and then he can make them /
more and more freely until he can walk. It is only the knee which is stiff; the hip, ankle and toes can be moved easily at all times. A momentary rest does not bring on the stiffness, and he says that a rest of 30 minutes or so is needed to cause the stiffness. He says that if he has been sitting still for a considerable period he often swings his legs at the knee for some time (2 or 3 minutes) before getting on to his feet and after that he can walk away quite well. He occasionally does this just as the lesson is ending at school and then he can walk away as quickly as the other boys.

When he changes from a walk to a run he can't attain his best speed at once but his speed gradually increases. Even when he is running his hardest, however, most of the other boys leave him behind. He can keep running for as long as most of the other boys, he says, and once he ran (trotted) from Bellshill to Hamilton (2 - 3 miles) in three quarters of an hour when he was 9 years of age. On another occasion when he was 7½ years he walked from Bellshill to Coatbridge (about 2 or 3 miles).

He says that when his legs are stiff there is never any pain and he feels nothing at all in them.

When once he has walked for a few minutes the dragging of the legs is barely noticeable.

As another example of the difficulty of changing movements of the legs it is to be noticed that after walking quite well he has difficulty and stiffness when he starts to climb stairs and does so in a clumsy, lumbering fashion but improves if the flight is a long one.

The left leg is the worse and has always been so. Both legs
been improving somewhat before he came in, but this improvement is greater since he came into hospital.

As to his hands, his mother says that "stiffness" was first noticed in them when patient was 6 years old. Patient says that after closing his hands or grasping anything he can't immediately completely open his hand. He can always open his hand immediately to some extent and this extent varies somewhat. Gradually the hand completes its relaxation and finally can be fully opened.

Patient says that the amount of difficulty is equal in the two hands at any one time, but varies in both from time to time. He can give no instance of circumstances or occasions which make it better or worse, but says definitely that there is no difference between Summer and Winter. His mother, however, is just as definite in saying that the condition as a whole is always worse in Winter. Patient says that the stiffness is no worse when he gets up in the morning than at other times of the day.

He has never noticed any stiffness of either of the elbows or shoulders.

There is no pain associated with the stiffness of the hands.

After opening and closing the hands for a few times the stiffness in opening ceases.

There is never any difficulty in closing the hand from any degree of the relaxed (open) position.

If he closes the hands quite loosely he says there is no stiffness in opening them - the stiffness is only after closing them firmly.
The hands were getting a little better before admission, but the improvement has been more since he came into the Infirmary.

When patient shuts his eyes tightly he has difficulty in opening them – they open slowly giving him the appearance of a person waking up in a bright light. If the eyes are closed lightly there is no difficulty in opening them on waking, for, as patient says, the eyes aren’t tightly shut during sleep.

Patient first noticed this difficulty of opening the eyes when he was sneezing.

Patient says that recently his jaws have remained fixed in a half opened condition when he was starting to eat something. This has occurred only a few times altogether. He describes the occurrence by saying that he would open his mouth to the normal extent to put in the first piece of food of a meal, and then for a short time (about 3 seconds according to a demonstration he gave me) his jaw remained fixed. After that he could close the jaw and the same stiffness never occurred twice in one meal.

Patient was seen at Glasgow Royal Infirmary 6 years ago by Professor Hunter who diagnosed hypertrophic paralysis. He was not taken into the Infirmary. Soon afterwards he was seen by Professor Bramwell who assured the parents that the disease would certainly not get much worse.
N.B. The more significant passages in the previous history, family history and examination are marked by a red line and the less important parts are inset.

PREVIOUS ILLNESSES AND ACCIDENTS.

When about 2½ years old patient had what his mother called a "fit". This occurred suddenly at about 6 p.m. when the child was being put to bed. He went black in the face, became unconscious for 10 minutes or so, but didn't make any convulsive movements. The doctor was sent for and he prescribed two powders. The child was all right next day and nothing of the kind has occurred since. Soon after this occurrence the child had chicken pox.

A rupture in the right inguinal region was present from the age of 2½ and was operated on at the age of 4 at the Sick Children's Hospital, Edinburgh.

FAMILY HISTORY.

Father. Alive and well.

Mother. Alive and well.

Brothers (2). 14 and 5½ years. Alive and well.

Sisters. (1). 3½ years. Alive and well.

Patient's mother states very definitely that neither she nor her husband nor any of their relatives or their children have symptoms similar to patient's.
STATE ON EXAMINATION.

Intelligence - above the average. Patient is 3rd in his class of 34.

Height. 4 ft. 5½".

Weight - 5 st. 13½ lbs.

Development - Very good with stoutness of calves, hands and face in particular.

Muscularity - In general good, with appearance of special muscular development of calves and face and to a less extent of thighs and hands.

GENERAL APPEARANCE etc.

A bright, intelligent boy with good colour in the cheeks and bright eyes. The face is square in outline.

The neck is rather thick and short and it measures 12½ cm., circumference, and 9 cm., from tip of chin to top of manubrium sterni when the head is held horizontally.

OBVIOUS MORBID APPEARANCE.

The muscles of the calves are large bulging and firm. The face has a larger and broader appearance than is usually seen in a healthy boy even when of a stout build.

The slowness and difficulty in opening the eyes after firm closure is the most easily seen morbid appearance. When seen in profile, the lips are thick and projecting.

EVIDENCE OF PREVIOUS DISEASE OR INJURY:

There is a linear scar 2½ inches in length in the right groin just above and parallel with the medial 2/3 of the right inguinal ligament.

Temperature - 97.5° F.
LOCOMOTOR SYSTEM:

Inspection & Palpation of Muscles.

On inspection the muscles of the whole body are seen to be very well developed but in some regions - namely, the calves, the anterior aspects of the thighs, the face and the thenar eminences - this development is specially well marked. In the face the masseters, buccinators and orbicularis oris are the bulkiest.

On palpation in the relaxed condition all the muscles are of normal consistence altho' the muscles of the forearm, thighs and calves are a little firmer than the others.

Measurement of limbs.

At a point 2½" above the bend of the elbow the right arm measures 8" and the left arm 8½".

At a point 1" below the bend of the elbow the right forearm measures 8½" and the left forearm 8".

Six inches above the upper border of the patella the right thigh measures 16½" and the left thigh 16½".

Five and a quarter inches below the upper border of the patella the right calf measures 11½" and the left calf 11½".

Strength of Muscles.

On the whole the muscles are strong in proportion to their good development, but some show decided weakness. Those which show most constant weakness are the flexors of the digits and the small muscles of the hand. It is difficult to be sure of the state of strength of the individual small muscles of the hand, but the grasp of the hand, altho' it varies, is weak. The strength of the grasp increases if continued for a time.

The deltoid, pectoralis major and minor and trapezius and rhomboids
rhomboids /

have been noticeably weaker than those of the left side on two occasions of examination, but at other times no difference between the two sides could be detected.

Rate of Contraction & Relaxation of Muscles.

From the relaxed position all the muscles could be immediately contracted and relaxation was equally prompt except in a few cases and then only after firm contraction.

The contractions which can't be at once relaxed are those of:—

(1). The flexor muscles of the wrist. When the wrist is loosely flexed dorsiflexion can be carried out immediately; but after firm contraction relaxation is slow and takes about 3 seconds to be complete the first time it is tried. Sometimes relaxation is immediately complete the second time and nearly always by the third time.

When relaxation is slow the flexor muscles can be felt to be firmly contracted and the flexor tendons at the wrist can be seen standing out prominently while the effort to dorsiflex is being made.

(2). The flexors of the fingers. Again firm contraction is required to elicit the slow relaxation. When the fingers are tightly clenched and the thumb folded over the closed fingers complete relaxation cannot be performed immediately and as a rule the fingers "stick" in a position at right angles to the palm with the thumb incompletely abducted - altogether resembling somewhat a spread out accoucheur's position of the hand.

The left hand is less easily relaxed than the right and in the left hand the thumb, middle and ring fingers are least easily relaxed.

Usually /
Usually at the second or third attempt relaxation is complete. After relaxation has been practised until it is immediately complete, incomplete relaxation doesn't return for a considerable time.

It is difficult to estimate the effect that the length of time of contraction has on the difficulty of relaxation, because as noted above the difficulty quickly disappears, but by trying different times of contraction on different days I came to the opinion that relaxation was as difficult after 5 seconds of contraction as after 30 seconds.

Placing the hands separately in cold water for 3 minutes made no difference in the rate of relaxation as compared with the hand which had not been put in the water. This test was repeated later with the same result.

After the hand and forearm had been held in cold water for 3 minutes there seemed to be slight but not marked increase in the difficulty of relaxation of the grasp of the hands.

(3). The orbicularis oculi. Again, slow relaxation was found only after firm contraction, and relaxation was more perfect on successive attempts. A record taken from day to day was as follows.

<table>
<thead>
<tr>
<th>Date</th>
<th>1st time</th>
<th>2nd time</th>
<th>3rd time</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/10/23</td>
<td>7 sec.</td>
<td>&quot; 5½ &quot;</td>
<td>immed.</td>
</tr>
<tr>
<td>31/10/23</td>
<td>5 sec.</td>
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</tr>
<tr>
<td>1/11/23</td>
<td>6 sec.</td>
<td>immed.</td>
<td></td>
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</tbody>
</table>

When a cold compress was held to the left eye for 3 minutes relaxation was slower than in the case of the right eye, immediately afterwards, by 2 seconds. Similarly with the left eye.
(4). The calf muscles. The facts here are exactly similar to those stated for the other muscles. Timing was difficult here because it is difficult to know exactly when the ankle is dorsiflexed to its full extent.

(5). The flexors of the toes. These muscles showed a slight, similar condition.

When patient begins to walk his gait is lumbering and slow. He leans forward and his legs move stiffly. If anyone takes his hand and tries to hurry him he tends to lose his balance. In a few minutes he walks more quickly and more easily. He is usually very any of trying to break into a run.

After walking for a short distance on his toes he can immediately walk on his heels, but in doing so he doesn't raise his toes very high.

When asked to "double mark time" he makes only 3 or 4 hops and then stops because, he says his calves become sore and stiff. This is the only time he speaks of soreness in connection with his complaint.

(6). The muscles of the tongue. On being asked to protrude and withdraw his tongue rapidly he usually starts with slow movements of small extent accompanied by much blinking of the eyes and evident effort, and then gradually the tongue movements become more extensive, more rapid and easier.

Myotatic irritability was well marked in the pectoral muscles, but not found elsewhere.

Electrical Reactions.

Galvanic electricity.
Left biceps muscle.

\[
\begin{align*}
&\text{CCC } \rightarrow \text{ACC } \rightarrow \text{AOC } \rightarrow \text{COC}.
&3.5 \text{ m-amps.} \quad 6.2 \text{ m-amps.} \quad 7.95 \text{ m-amps.} \quad 8 \text{ m-amps (1st reading)}
\end{align*}
\]
Left forearm (flexor carpi radialis).

\[
\begin{align*}
\text{CCC} & \rightarrow \text{COC} \rightarrow \text{ACC} \rightarrow \text{AOC} \\
1\text{st reading} & \quad 1 \text{ m-amp.} \quad 4.35 \text{ m-amp.} \quad 5 \text{ m-amp.} \quad 6.15 \text{ m-amp.} \\
2\text{nd reading} & \quad 1.75 " \quad 4.5 " \quad 7.25 " \quad 9.4 " \\
\end{align*}
\]

Right biceps muscle.

\[
\begin{align*}
\text{ACC} & \rightarrow \text{CCC} \rightarrow \text{COC} \rightarrow \text{AOC} \\
1\text{st reading} & \quad 2.4 \text{ m-amp.} \quad 2.8 \text{ m-amp.} \quad 3.3 \text{ m-amp.} \quad 5 \text{ m-amp.} \\
2\text{nd reading} & \quad \text{ACC} \rightarrow \text{CCC} \rightarrow \text{AOC} \rightarrow \text{COC} \\
& \quad 2.0 \text{ m-amp.} \quad 3.1 \text{ m-amp.} \quad 4.75 \text{ m-amp.} \quad 6.15 \text{ m-amp.} \\
\end{align*}
\]

Right forearm (flexor carpi radialis).

\[
\begin{align*}
\text{CCC} & \rightarrow \text{ACC} \rightarrow \text{AOC} \rightarrow \text{COC} \\
& \quad 2.25 \text{ m-amp.} \quad 2.5 \text{ m-amp.} \quad 5.2 \text{ m-amp.} \quad 5.85 \text{ m-amp.} \\
\end{align*}
\]

Right Calf.

\[
\begin{align*}
\text{CCC} & \rightarrow \text{ACC} \rightarrow \text{COC} \rightarrow \text{AOC} \\
& \quad 8.0 \text{ m-amp.} \quad 9.6 \text{ m-amp.} \quad 10.8 \text{ m-amp.} \quad 13.3 \text{ m-amp.} \\
\end{align*}
\]

Left Calf.

\[
\begin{align*}
\text{CCC} & \rightarrow \text{COC} \rightarrow \text{ACC} \rightarrow \text{AOC} \\
& \quad 5.3 \text{ m-amp.} \quad 5.9 \text{ m-amp.} \quad 7.75 \text{ m-amp.} \quad 8.8 \text{ m-amp.} \\
\end{align*}
\]

Faradic electricity.

Left biceps. Contraction occurred with resistance at 7.8 cm. Contraction was immediately released after passage of current for 2 and for 5 seconds.

Left flexors pf forearm. Contraction occurred with resistance at 7.7 cm. Contraction released immediately after passage of current for 2 seconds.

Left extensors of forearm. Contraction occurred with resistance at 7.2 cm.

Contraction immediately released after current for 2 seconds.

Right biceps.

Contraction /
Contraction occurred at 7.2 cm; immediate release after 2 seconds.

Right flexors of forearm.

Contraction at 7.1 cm; immediate release after 2 seconds.

N.B. Passage of current for longer periods than 2 or 3 seconds, when strong enough to cause contraction, was painful.

Joints.

Passive and active movements are easy and painless at all joints.

There is no abnormal mobility.
NERVOUS SYSTEM:

Intelligence - Above the average - he is 2nd in his class.

Emotional state - Nothing to note - a bright sharp little fellow.

Memory - Good.

No hallucinations nor delusions discovered or suspected.

Sleeps well.

No delirium, nor drowsiness.

No coma, no fits.

Speech - nothing to note.

Patient is right handed.

Cranial Nerves.

I. Sense of smell is present and normally accurate by both nostrils.

II. Visual acuity - good for distant objects in both eyes.

Patient says that the doctor tells him he should have glasses for reading.

Fields of vision - unimpaired in either eye.

Ophthalmoscopic examination.

Both discs and eye grounds are normal, with little pigment except at the edge of the optic discs.

III. Ocular movements normal in both eyes.

IV. No ptosis; no squint.

VI. No diplopia. No nystagmus.

Pupils - rather wide. Equal in size and both regular in shape.

Reaction to light is prompt and equal in both eyes, both by direct and consensual tests.

Reaction to accommodation is present, prompt and
equal in both eyes.

V. Motor - Masseter, temporals and pterygoide are strong on both sides. There is sometimes signs of slightly slow opening of the jaws after tight clenching and he seems to open them more quickly on repetition, but this isn't marked.

Sensory.

Face - sensitive everywhere to touch, pain heat and cold. Tactile Discrimination

\[
\begin{align*}
\text{forehead} & : 1.1 \text{ cm.} \\
\text{left cheek} & : 8 \text{ cm.} \\
\text{right cheek} & : 1.0 \text{ cm.} \\
\text{chin} & : 0.7 \text{ cm.}
\end{align*}
\]

 Conjunctiva, mucus membrane of mouth and nose sensitive to touch.

VII. Muscles of face are all strong.

They all contract immediately on command, and relax immediately except the orbicularis oculi which doesn't relax if contracted tightly, but does after light contraction of only the palpebral part of the muscle and after relaxation has been practised 3 or 3 times. For fuller account, see locomotor system.

Taste - Sense of taste of sweetness, bitterness and saltiness on 1/3 of the tongue on both sides.

No hyperacusis (by patient's statement).

VIII. Hearing - good in both ears - watch heard at over 2 feet.

Tuning fork tests - air conduction better than bone conduction. Both conductions heard normally well.

No tinnitus.

No vertigo.

No otorrhoea.
IX. Taste present for salt, sweet and bitter on both sides of post. third of tongue.
No anaesthesia of pharynx.
No dysphagia.

X. Palate movements good.

XI. Sternomastoids and trapezius strong on both sides and contract and relax immediately.

XII. Tongue can be protruded to normal extent and comes out without divergence to one side or the other.
The difficulty and slowness in protrusion is noted in the locomotor system.

**Cervical Sympathetic.**

Both eyes dilate readily to shade by direct and consensual tests.
Cilic spinal reflex present in slight degree.
No proptosis.
No exophthalmos.
Eyes are rather deeply placed, but no evident enophthalmos.
No flushings of face, neck or upper limbs.

**Reflexes.**

Conjunctival - present on both sides.
Pharyngeal - present
Palatal - present on both sides.
Abdominal - present on both sides.
Plantar - flexor response (slight) on both sides.
Elbow - Left present. Right present.
Knee - Left present on reinforcement only.
Right present with or without reinforcement.
Patellar clonus - absent on both sides.
Ankle jerk - present on both sides.
Ankle clonus - absent on both sides.
Supinator - present on both sides.

Micturition - Patient says that sometimes but not often he wets the bed at night. Recently before admission, this happened 3 nights in succession at a time when patient was in bed for 3 days after eating 1/6d worth of apples and pears. The urine passed while patient was asleep and, as on a former occasion 4-5 months, before, some pills cured him.

Patient passes water about 4 times during the day, no times at night and there is no pain or difficulty attending the act.

Sensory Functions.

No subjective phenomena.

Sometimes he has slight headaches, but they go away on taking an "Abdine".

No vertigo.

Objective Phenomena.

Sense of touch present on all parts of limbs and trunk. Responses to touch stimuli are all rapid.

Sense of pain and of pressure present on all parts of upper limbs.

Sense of heat and cold present on all parts of chest, abdomen, lower limbs, upper limbs and back.

Responses to all sensory stimuli are prompt, and heat can be appreciated immediately after cold on the same spot.
ALIMENTARY SYSTEM

No subjective phenomena.

Lips - rather thick especially when seen in profile. Good red colour.

Teeth: Upper jaw. Right canine broken to a small piece of loose stump. Second and third right molars not visible.
Third left molar not visible.
Lower jaw. Second right molar decayed.
Third right molar not visible,
Third left molar not visible.
All the other teeth of both jaws are in good condition and clean.

Gums: Good red colour.
No bleeding or pyorrhoea.

Tongue: Rather slightly furred.

Fauces: On right side the ant. pillar is bulged forward a little and the tonsil is seen projecting further towards the middle line.

Abdomen.

Inspection.
A well rounded but not protuberant abdomen, symmetrical, no abnormal prominences or retractions.

Palpation.
No resistance nor tenderness. No fluctuation.
Slight gurgling on pressure in right iliac fossa.
Liver reaches 4th right intercostal space in the nipple line and just reaches the costal margin in the nipple line.

The /
The stomach by percussion and auscultatory percussion seems rather small - the lower border reaching only to a point \( \frac{1}{2} \)" above the level of the umbilicus \( \frac{1}{2} \)" to left of median plane.
HAEMOPOIETIC SYSTEM.

No subjective phenomena.

In the neck there is a chain of enlarged glands on the right side just in front of the trapezius. These are not visibly enlarged but are easily palpable.

On the left side of the neck there are some palpable but less enlarged glands in front of the trapezius.

There are a few palpable glands in the right axilla.

No glands palpable in left axilla nor in either groin.

Spleen not palpable.

Thyroid palpable but not enlarged, nor hard.
CIRCULATORY SYSTEM.

No subjective phenomena.

Pulse.

Arterial wall is soft - almost impalpable.
Frequency - 84 per minute.
A small degree of sinus arrhythmia detected on deep breathing.

Force - regular.
Character of wave - Upstroke not of great extent, but normally forcible. Downstroke normally rapid.
Sphygmographic tracing. Illustrates the points noted above and shows no other abnormalities.

Arterial Pressure - Systolic 96.
          Diastolic 68.

Heart.

Inspection of precordial region.
Symmetrical in form with no abnormalities.
Pulsation - a slight pulsation seen in 4th left intercostal space just within the nipple line.
No extra cardiac pulsations.

Palpation.

The apex beat is palpable in the 5th left intercostal space just outside the nipple line 3 1/2" from the median plane in a horizontal direction.

Percussion.

The right border of the heart cannot be palpated beyond the right margin of the sternum. The left border of the heart is in its normal position or very slightly beyond it and the apex is percussed in the 5th left
intercostal space, just on the nipple line.

Auscultation.

Both sounds are well heard are closed and not accompanied by any abnormal sounds in mitral and tricuspid areas.

In the aortic area the sounds are closed and the second sound is reduplicated - the reduplication being just audible.

In the pulmonary area the sounds are somewhat faint, are closed and the second sound is just audibly reduplicated.

Electrocardiogram shows no abnormalities in the waves.
RESPIRATORY SYSTEM:

No subjective phenomena.

Breathing - 18 per minute.

Sometimes nasal, sometimes oral.

Thorax - Inspection.

Form - Rather a broad, flat chest, with Harrison's sulcus seen on both sides.

Chest moves well and equally on the two sides.

Palpation.

Confirms movements noted by inspection. Vocal fremitus is more marked on right side than on left, as normal.

Percussion:

Apices reach 1½" above clavicle and become more resonant on deep inspiration.

Tidal percussion - expansion good.

Auscultation e nothing to note.
INTEGUMENTARY SYSTEM:

Impetigo contagiosa is present on legs and face and the lesions heal in one place and break out again.

URINARY SYSTEM:

No subjective phenomena.
No tenderness in kidney angle.
Urine - 20 - 40 oz. per diem.
Clear straw or amber.
No abnormal constituents.
Creatinin - 0.09 grams %
0.675 grams per diem.
PROGRESS NOTES.

17/11/23. The condition of the delayed relaxation of muscles has steadily improved in all cases and often cannot be observed at all in the hands.

30/11/23. Eyes after closure for 10 seconds - 1st time 3 1/2 seconds for complete relaxation: 2nd time 1 1/2 seconds for complete relaxation: 3rd time immediate.

A cold compress was applied to the right eye for 30 seconds, the eyes were tightly shut for 10 seconds and the time necessary for the right to open completely was 6 seconds and for the left eye 3 1/2 seconds.

Hands after firm grip for 10 seconds were relaxed almost completely (and to the same extent in both) the first time; and quite completely the second.

After immersion to the elbows in very cold water for about 1 1/2 minutes the relaxation after firm closure of the hands was not quite so complete as the first time recorded above without immersion; but timing is difficult because the defect in immediate relaxation wasn't great and it is difficult to be sure just when relaxation is quite complete.

The relaxation of the calf muscles is slow and patient cannot to-day "double mark time"; on attempting to do so he stops after making one hop on the left foot; immediately he raises his right heel the calf becomes stiff and a little sore. On "marking-time" he doesn't raise his knees as high as a Sergeant-major would demand and he tires after about 10 steps with each foot. He cannot run well this morning, but improves on exercise.

The calf muscles of the left leg are firm during relaxation; but not noticeably so on the right side.
Diagnosis. Myotonio Congenita (Thomsen's Disease). For differential diagnosis, see discussion at end of the case.

Treatment. When patient came into hospital, it was decided to keep him under observation for a fairly long period before medicinal or other treatment was begun in order to observe the effect on the condition of rest in bed and changes in the atmospheric temperature. The condition steadily improved during these weeks of observation and the parents insisted on taking the patient away just before a course of atropin was to have been begun. Professor Bramwell was anxious to see what effect atropin would produce because he had previously had under his care a patient suffering from myotonio congenita whose symptoms had entirely disappeared after atropin had been exhibited.
Short Resume of the Salient Features of the Case.

Patient is a well developed, intelligent boy of 11 years whose general health has been very good and whose only present complaint is a difficulty in relaxing certain muscles after contraction. The parents first noticed the condition when patient was 3 or 4 years old and on the whole the symptoms have become slowly but steadily more marked ever since.

The muscles affected are the orbicaulares oculorum, the flexors of the wrists and fingers, the calf muscles and flexors of the toes on both sides and, more doubtfully, the muscles of the tongue.

Another feature is the bulkiness of certain muscles particularly those which show the slow relaxation.

The patient is a strong boy for his age but the bulky muscles are the weakest.

The disease caused no real handicap, but only handicapped the boy in playing vigorous games.

The difficulty of relaxation occurred only after the first few contractions following a period of rest.

Low temperatures made the condition a little worse and high temperatures improved it to a corresponding amount.

The length of time that the contraction was kept up had no effect on the difficulty of relaxation so long as the contraction was firm and lasted for at least 5 seconds.

The results of Galvanic stimulation to affected and unaffected muscles were very inconclusive. As to Faradic stimulation the affected muscles relaxed immediately after the passage for 2 seconds of a current just strong enough to cause a contraction. The current couldn't be used stronger or for a greater length of time.
time / 
on account of the pain caused to the patient.

**Treatment:**

Rest in bed with light diet for two weeks followed by exercise in the wards for 4 weeks.

**Result.**

Improvement of the symptoms.
DIFFERENTIAL DIAGNOSIS & COMMENTARY.

In this case the diagnosis of Thomsen's Disease is justified by the slow relaxation of certain muscles after they have been contracted voluntarily following a period of rest, and by the subsequent improvement and disappearance of this slowness if the muscular action is continued.

Other diagnoses which might be suggested by certain features of the case are:— (1) Hypertrophic or pseudohypertrophic paralysis. 

(2). Paramyotonia congenita (or other less well known forms of myotonia).

(3). Tic (especially blepharospasm).

(4). Hysterical paralysis and spasm.

(1). The diagnosis from hypertrophic paralysis is important because in almost all recorded cases of Thomsen's disease the large size of some or all of the muscles is noted with either no corresponding increase of power or actual weakness. Sometimes atrophy follows hypertrophy and a case is recorded in which extreme atrophy gradually increased over the condition of combined hypertrophy and atrophy seen at first. 

Our patient was generally well developed and strong in proportion: but on the one hand the muscles of the calves, of the anterior aspect of the thighs and of the face were particularly bulky and firm, and on the other hand the muscles of the forearm and hand and perhaps those of the left shoulder girdle were below the normal in power.

The diagnosis of a hypertrophic type of muscular dystrophy is inadmissible in this case owing to the undoubted slowness of relaxation of some of the muscles which is a phenomenon not seen in simple muscular dystrophies.
(2). Paramyotonia Congenita is a condition much rarer even than Thomsen's disease and is evidenced by tonic spasm lasting from a quarter of an hour to several hours, excited chiefly by cold, although often by merely slight cold, and the rigidity is followed after a time by weakness.

Such a description never applied to the complaint of our patient, and therefore the diagnosis of congenital paramyotonia is inapplicable to this case.

(3)
Other "forms" of myotonia have been described on the basis of differences in the various circumstances attendant on the characteristic symptom but the divisions made overlap one another and only need to be referred to:

- Myotonia atrophica.
- Myotonia congenita intermittens.
- Myotonia acquisita.
- Partial myotonia.

(3). The diagnosis between tics, especially blepharospasm, and Thomsen's disease is especially interesting in view of a case of facial tic in this series.

In the present case the diagnosis of tic is inapplicable for several reasons. The commencement of the trouble was noticed when the child was 3 or 4 years old which is before the age that any tic develops. The occurrence of the spasm of the eyelids, hands, legs etc. is conditioned by one thing only and always occurs when that condition is fulfilled - namely contraction after a period of resting, and the slow relaxation is not accompanied by any feeling of satisfaction or mental inevitability. In a tic the contraction as well as any slowness of relaxation is involuntary, occurs at irregular times and under very/
varying conditions, and is accompanied by a feeling of satisfaction or is thwarted at the expense of mental pain.

(4). Hysterical Paralysis and spasm.

Byrom Bramwell records a case in which a man aged 26 was suddenly seized by a cramp-like pain from the waist downwards with severe tonic contraction of all the muscles of the lower limbs. These disappeared after an hour, but recurred afterwards on the least exertion. Thomsen's disease was considered as a possible diagnosis, but examination showed a state of almost complete skin analgesia and other sensory disturbances and a complete cure was worked by isolation, good feeding and suggestive therapeutics only.

In our case the age of onset, the absence of sensory changes and the presentation of the exact phenomena of Thomsen's disease exclude hysteria.
AGE OF ONSET.

The characteristic stiffness, as patients call it, is noticed usually in childhood but has been seen in infants in the cradle. Patients themselves often state that the difficulty in some or other action has been present as long as they can remember.

The first evidences of the disease were seen in our patient when he was 3 or 4 years old.

Sometimes the disease is first evident at or about puberty and in a few cases at a more advanced age, as in early manhood after great emotional excitement due to lightning or alarm or after two years very strenuous work. One woman developed the stiffness at the age of 38 when she was pregnant with a child who showed the disease from birth.

Many of these late cases may of course have shown slight degrees of the condition before the supposed onset, but some may deserve the name acquired myotonia referred to in the differential diagnosis.

SEX.

The disease is much commoner in males. In a series of 102 cases 91 were males and 11 females.

FAMILY INCIDENCE and HEREDITY.

In many cases patients have relatives (including parents, brothers, sisters, cousins etc.) affected with the disease, but often, especially in mild cases like our patient, no family history of the disease can be obtained. A case has been reported lately in which 2 out of 13 children in a family were affected (6).
Thomsen considered that a neurotic temperament usually accompanied the disease or was common in the family but this is not usually borne out by investigation and was not so in the case under consideration.

**EXTENT and CHARACTERISTIC FEATURES.**

The case recorded here is a slight one but any, and in extreme cases almost all, of the muscles under voluntary control may be involved. No abnormalities in the acts of respiration, swallowing, micturition, defaecation or parturition have ever been noted although these acts are to a greater or less extent voluntary. The muscles of the limbs and trunk and those of the face and jaws are most commonly affected.

The constantly observed features of slow relaxation in the muscles concerned were well seen in the case we are considering.

A rest of 20 minutes or so is needed to bring out fully the delayed relaxation in the calf muscles, and although the time wasn't tested a definite period without contraction was necessary in the other muscles affected also. A feature clearly shown is that when the eyes are lightly closed (as in sleep) and the palpebral parts only of the orbiculaires oculorum brought into play there is no difficulty in opening the eyes and the slow relaxation occurs only when the eyes are firmly closed with the aid of the orbital and palpebral parts of the muscles. In a similar way, firm closure of the hand, but not gentle closure, is followed by slow relaxation. I think there is no reference to such a difference in the records I have read.

(5)

Wardrop Griffith in one of his cases dwells on the fact that a firm contraction if kept up for 15 seconds or longer was immediately /
immediately /
followed by complete relaxation, but although the point was
tested this was not found to be so in our case.

The second and subsequent contractions were relaxed in
shorter and shorter time. Difficulty in opening the eyes
never occurred after more than two consecutive closures and
often only once and similarly with the hands and legs. In
more marked cases of the disease the first relaxation occupies
much more time and the action has to be repeated many times
before the condition is normal.

As is usual in the condition our patient found that every
new movement or change of movement in which the affected
muscles were involved required to be performed a few times
before it was easily accomplished. This was most noticeable
in movements of the lower limbs. Just before the end of a
lesson he swings his legs and feet for a few minutes so that
he can get up and walk away when the class is dismissed.
But when a rush is made for the door he must run and then his
first few hastened steps are lumbering and heavy. If he has
to climb a stair he catches the banister more tightly than the
others and mounts the first few steps singly and clumsily, and
if he is knocked into he tends to lose his balance. None of
these things causes him hardship but he is self conscious and
uncertain of himself at times and perhaps in a slight degree,
to quote Thomaen's words, the disease "casts a shadow" over
his life.

The existence of adequate muscular tissue in the legs is
made manifest by the long distances which he walked when less
than 10 years old.
In most textbook accounts I have read cold is said to be a factor in making the symptoms more pronounced in the majority of cases, and this was found to occur in our patient both as regards weather and the application of cold water.

There were no sensory symptoms to be noted, which seems to be the case invariably, and no aberration was detected in the function of the heart (as evidenced by pulse tracing and electrocardiogram) nor any of the other internal organs except the occasional occurrence of nocturnal enuresis, which was a permanent symptom in the case reported in the B. M. J. and referred to above.

The reflexes were normal except that the left knee jerk was present on reinforcement only. In most accounts of the disease it is stated that all the reflexes are normal but detailed accounts of actual cases often show increase or decrease of various reflexes.

Hale White says that contraction as well as relaxation is slow in the affected muscles. This wasn't observed in our case.
ELECTRICAL REACTIONS.

In this case the results of galvanic stimulation of the muscles were, unfortunately, contradictory and not much conclusion can be drawn from them and after a contraction was obtained in some of the affected muscles by the passage of a current for 2 seconds relaxation was immediate and complete. The strength of current used was only a little above the minimal because of the pain caused by even the momentary passage of a strong current.

The typical myotonic reactions of Erb include the following features:— (1) The faradic current applied strong to the muscles sets up a long lasting contraction.
(2) When galvanism is applied to the muscles KCC is as easily obtained as ACC.
(3). The slow relaxation does not improve with successive electrical stimulations as it does after voluntary contractions.
CHANGES IN MUSCLES.

There was no examination of portions of affected muscles in our case, but this has been done repeatedly and certain definite abnormalities reported.

(1). The transverse diameter of fibres is found to be 2 or 3 times the normal.

(2). Cross-striation is less marked than usual.

(3). Nuclei are more numerous and are found in the centre as well as at the periphery of the fibres.

(4). Degeneration of the fibres in atrophic cases.

It is noticeable that no account of the histology speaks of a large increase of fat such as is found in pseudo-hypertrophic paralysis.

At least two observers consider that the changes described are artefacts produced entirely by post-mortem contraction of the muscle, and one of them states that the same appearance may be seen in normal muscle if it contracts after death.
CHANGES IN NERVOUS SYSTEM.

Until recently only one autopsy had been reported, by Dejerine and Sottas, and by a most careful examination they could find nothing abnormal in brain, spinal cord or peripheral nerves. But last December extensive changes in the nervous system in the case of Thomsen's disease were announced to the Societe de Biologie de Paris.

1. Le noyau lenticulaire: atrophie modérée et infiltration "pigmentaire brune des grandes cellules du putamen; "élions "identiques moins accentuées des petites cellules; transformation "progressive des cellules des globus pallidus en petites boules "hyperchromiques.

2. La substance de Reichert, les noyaux du tuber et "periventriculaire: atrophie cellulaire et vacuolisation du "protoplasma.

3. Les groupes à pigment noir: atteinte inégale du locus "caeruleus, du noyau dorsale du vague, de la formation reticulée; "le locus niger est peu touché.

4. Les cellulares vesiculeuses: atteinte légère des noyaux "dentelés, de la formation medullaire. Ces alterations du "type abiotrophique frappent non pas au hasard, mais des groupes "rattachés d'une part à la voie extrapyramidal, de l'autre "au système végétatif; leur distribution est donc systématique. "Elles différent des processus préséniles par l'absence de "vascularites et de désintégration vraie, la répartition différente "de l'intensité des lésions et leur aspect. Elles se rapprochent "plutôt de celles des myopathies."

The last sentence in this report makes us wonder how much hypertrophy or atrophy of muscles was present in this case, since we /
we know that some degree of one or other is usually present. Changes in the nervous system are not always found in cases of myopathy at post-mortem, and when observed are usually considered to be secondary to muscular degeneration.
THEORIES AS TO CAUSE OF THE SYMPTOMS.

The site of the primary lesion has not yet been accurately demonstrated but most writers think it will be found in the muscles themselves - a theory which is being rather unsettled now by weighty claims for the nervous system.

Thomsen thought that the disease was a neurosis, but the usual absence of neurotic symptoms or history has discredited his theory and when these symptoms are found they are regarded as secondary.

The similarity of the contractions in Thomsen's disease and in muscles poisoned by veratrin or stimulated after the injection of sodium phosphate has been used to show at least the possibility of the disease being primarily muscular, but it is not supposed that either of the drugs named is present or responsible.

The purely muscular theories of the disease are based on a supposed structural abnormality in the fibres associated with abnormal function. According to some writers the enlargement of the fibres is not the primary peculiarity but results from the long tonic contractions; others consider that the muscles have a much greater proportion than usual of large red, tonically contracting fibres and a smaller proportion of small, pale fibres which contract and relax more rapidly. This theory was put forward by Knoblauch who discovered these two types of fibres in rabbits and later Schafer observed the same difference in human muscle. It may be noted that myasthenia is, on this principle, said to be due to a too large proportion of pale fibres, that myotonia and myasthenia are therefore the converse of each other.
Objections to this theory are found in cases which develop the disease at a relatively advanced age, such as that of a man who had perfect health and was an ardent football player up to the age of 26 when he began to have several attacks of rheumatism followed gradually by extreme hypertrophic and atrophic myotonia. Also cases have followed great excitement or hard work and during pregnancy in patients over twenty. The invariable improvement after successive contractions and the necessity for a considerable period of rest before the phenomenon recurs throw doubt on the theory because we should need to make such a supposition as that the red, slowly contracting fibres are numerous enough to dominate the picture in the first few contractions, but very soon tire and then the pale fibres, which can not be numerous in muscles which show no enlargement, are able, in many cases at least, to perform accurately and rapidly the normal functions of the muscle for a normal period; or else the pale fibres might be supposed to be refractory to the first few stimuli to which the red fibres alone responded, but this is not in accordance with observations on the pale variety of muscle.

Another point in controversy is this - When muscles are "resting" there is really a state of balanced tonic contraction of their tonically contracting elements and yet even in patients affected in all their muscles this muscle tone is at once decreased to allow opposing muscles to contract, and as specially noted by Wardrop Griffith passive movements (which involve relaxation of all muscle tone) are normally free.

It must also be remembered that in our case no difficulty followed /
gentle contraction (as of the eyelids in sleep etc.), that muscles never show the slowness of relaxation after reflex or involuntary contraction although it may be constant after the first voluntary movements.

A theory centres rather vaguely round the formation and excretion of creatinin. Creatin appears in the urine only rarely, after ingestion in the food or while there is a rapid disintegration of muscle protein as in acute fevers. Creatinin differs from creatin by the loss of a molecule of water and is always excreted in the urine in very constant amounts per diem in any individual. The chief factor which influences the creatinin excretion is the absolute amount of muscle tissue, the intactness of its trophic nerves and its potential efficiency, whereas the amount of muscular activity is in itself wholly without effect.

A marked decrease in the amount of creatinin excreted is found in such diseases as progressive muscular atrophy and primary muscular dystrophy and a decided increase in its excretion would denote increased tonus or increased amount of muscle tissue or both. The creatinin output may therefore indicate the general atrophy, hypertrophy and efficiency of the muscle tissues but throws no light on the delayed relaxation which is characteristic of Thomsen's disease. In our case the amount of creatinin excreted in a 24 hours sample of urine was 0.675 gms. which is a rather low figure but within the rather wide physiological limits estimated by various observers.

The theory which is gaining most ground at present is that the disease is primary, to some extent at any rate, in
nervous system, and in that connection the report of a 
(7) post mortem in Paris, recorded above, may be important.
Points in favour of a lesion in the nervous system are that 
voluntary movements of a muscle may be followed by the delayed 
relaxation, but reflex or involuntary contractions never are, and 
that the symptoms may appear suddenly during adolescence or 
adult life after an emotional shock. The case for this theory 
is very clearly put by Findlay in his report already referred 
(1) to, and as further arguments he presents the fact that the 
condition gradually disappears on a repetition of voluntary 
movements, and does not do so on a repetition of direct or 
electrical stimulation and also the observation of Ringer and 
Sainsbury, that certain fibrillar contractions, observed in 
myographic tracings of the abnormal contractions, could be 
eliminated by curare. This last experiment in itself 
possibly points to faults in muscles as well as in the 
nervous system and that seems to be the farthest that careful 
observations and reasoning have yet led.
PROGNOSIS, etc.

No means has been found of curing the disease, but it sometimes remits and may even quite disappear. No case of death due to the disease alone has been recorded, and even where most of the muscles are involved inconvenience and embarrassment more than actual hardship or danger are usually caused. Thomsen believed, and it is usually advocated, that an active life gives the best chance of improvement and one patient recorded by Griffith, whose muscles were extensively involved worked in a warehouse and had so much made concealment of his trouble an instinct, that no other employee knew of his disability.

Of course the addition of atrophy severely complicates the outlook.

Measures which have been followed by striking remissions are available only to the female part of mankind - namely pregnancy and delivery.

Professor Bramwell had a case which the symptoms entirely disappeared after a course of atropin had been given.
TREATMENT and MANAGEMENT.

In the absence of any drug or physical therapy known to cure the disease the advice given is to lead an active life regardless of the condition so long as atrophy is not present.

For a mild case at any rate, marriage seems a drastic and "chancey" measure to advocate to a female patient.

In our case the patient was kept in bed and given no special treatment for a fortnight, and then allowed to be up and about the ward for the other 4 weeks of his stay in hospital. The marked improvement must be ascribed to warmth, chiefly.

It was intended to give a course of atropin and submit the patient and his curious complaint still further to the light of scientific day, but, alas, his mother came one Saturday - a very Atropos to our hopes -, insisted on taking away her child and like life from the body of T. Inrnis, "fugit indignata sub umbras".
REFERENCES.


7. FOIX et NICCOLESCO, "Alterations du Systeme Nerveux dans un cas de Maladie de Thomsen" - Paris Medical 15/12/23. p. 528.
WIGHTMAN PRIZE COMPETITION.

Six Cases
Entered by
J. M. Alston.

Case II. Tic Involving the Eyelids.
NAME - DUNCAN DEWAR.
ADDRESS - Naismith's Buildings, Chirnside.
AGE - 46 years.
OCCUPATION - Commercial Clerk.
PLACE OF BIRTH - Glasgow.
DATE OF ADMISSION - 25/12/23.
DATE OF EXAMINATION - 1/1/24.

COMPLAINT - "Partial blindness and loss of control of the eyelids, but the sight is all right".

DURATION - Since May 1923.

HISTORY - PERSONAL.

Until May 1923 patient considers that he was in perfect health in every way. He had been out of work from September 1922 until May 1923 and naturally this had depressed him - the unemployment pay he received was £1 a week and he has a wife and two children to keep - but he is sure that his physical health was in every way good during this time.

On 16th May patient began work as Inspector of Poor etc. to the Parish Council of Duns. The work was quite within patient's capacity and consisted mostly of clerical work which patient could do in his own time and which didn't fully employ him. About a week after he began this work he was set to draw up the balance sheet of the Council, and while occupied at this he noticed that his sight was becoming weak (as he then thought) because he couldn't see clearly to read or write since the print or writing became dim and blurred soon after he began to look at it. At first this dimness of vision occurred only /
only/
at his work and after he had been using his eyes at his books for an hour or so. He thought that it might be because his reading glasses needed to be changed, but the difficulty increased and was noticed also when walking in the street and when reading etc. at home.

Patient was afraid that he was going to lose his sight, and was considerably worried as he was already impeded in his work.

Patient had been spending some of his time from the 1st of May in helping his father-in-law every other day to cut a tennis lawn. He found no difficulty with his eyesight when doing this until the end of June and then he found that soon after beginning to mow he couldn't see what part of the grass was cut and what part wasn't and he had to take a rest in the pavilion before his sight recovered enough for him to resume.

He first consulted his doctor - Dr. M' Watt of Duns - in the beginning of August and he was given a prescription which did no good altho' patient had three bottles of medicine made from it.

At the end of August patient went to the Eye Department, R. I. E. and saw Dr. Cameron who reported that his eyesight was unimpaired. When patient heard this report he began to wonder how his defective vision was caused and he soon found that his eyelids were drooping when he couldn't see, and that if he lifted up his eyelids with his fingers he could see perfectly well.

By the time that patient came to see Professor Bramwell in November 1923 the condition had advanced so much that practically speaking he had difficulty in seeing all day long and often/
often / patient felt unsafe in the street. When walking in the street he could see the pavement etc. for only about 2 yards in front of his feet and altho' he could see everything quite clearly within this short range he often met with such minor accidents as catching his foot on a doorstep, knocking into a wall, hitting his face on a rope which was stretched across his way. Immediately after he received the shock of such an impact his eyes always opened quite widely so that he could see perfectly well, but they gradually closed again afterwards. The difficulty of vision occurred also at home and patient thinks he was worse there than at the office or in the open air, and he explains that his house is very brightly lit by big windows and the office very badly lit. When he dimly perceived bright lights on the road at night - such as motor car lights - his eyes opened widely until the lights were out of sight.

He also says that when he looks into a mirror he can see his eyes gradually open wide and remain open while he looks at the mirror.

Altho' the condition was becoming progressively worse, patient noticed that from the beginning and all through the course he had no difficulty, or very little, when he was meeting other people in the course of official business. Examples of this are that he could read the minutes of the Parish Council at the beginning of the meetings and could take notes of the proceedings in order to compile the next minutes, and during the whole of these meetings (which lasted about two hours or so) he had much less difficulty in seeing than during the rest of that day; also if /
if one of the councillors came into the office during the day patient could read to him anything he required and patient could always carry through any outdoor business such as visiting people without any difficulty. When he was working alone in the office and whenever he was off duty, however, his eyelids drooped so that his range of vision was very small.

At his examination by Professor Bramwell at an out-patient clinique in November patient had great difficulty in opening his eyes after closing them tightly and to a certain extent his appearance suggested myotonia but with this big difference that after the first long tonic contraction of the eyelid muscles was overcome there were several clonic contractions before the eyes remained permanently open, whereas in myotonia there are no such clonic contractions after the tonic contraction is relaxed.

Patient states that in cold or windy weather the difficulty in keeping the eyes open is more marked.

He says that his eyes have always been sensitive to bright sunlight and to wind, and that this sensitiveness has increased since the difficulty in keeping his eyes open started. Because of this sensitiveness of his eyes to light and sun he has always been in the habit of shading his eyes with his hand or half closing them, in order to protect them. His eyes have always watered easily and became inflamed readily, and he often bathed them with boracic lotion.

Patient first got eye glasses in 1910 in order to improve his vision of near objects only. These glasses were changed in August 1922, and at the same time patient got glasses for distant
distant / vision but these latter have not been much needed and patient has not worn them regularly, as he states that although they improve his sight sometimes, at other times he sees worse with them than without them.

Patient does not consider that he is a nervous man, but he remembers that before the War as well as after it he sometimes found a stiffness of his hand when he was writing which didn't prevent him continuing to write but made his writing less legible. He volunteered the information that sometimes after he had experienced this cramp or stiffness while writing at the office during the day, yet his hand would be very free and his writing very good when he wrote at home on the same evening.

Patient states that he has no involuntary, often repeated movements of the limbs or face. This information was elicited to discover if he has been subject to tics and he showed that he understood the nature of the actions inquired about by giving examples of tics which he had noticed in other people.

Patient is sure that he has lost a good deal of weight during the last six or seven months since the difficulty of sight has been present, and he is also more irritable and more easily annoyed than formerly. He says that he feels constantly tired and a night's sleep doesn't bring the refreshment which it used to do.

To give another example of the variability of the degree of his symptoms, he says that yesterday he had very great /
great /
difficulty in seeing the note paper and his writing while writing a letter to a friend about a business matter, while on the day before he wrote a long letter home with very little difficulty although of course, as usual when he writes, he needed to hold up his eyelids with his fingers.

Also, he states that last night he was able to help the night nurse to control a patient who was delirious and during this time he had no difficulty at all in seeing.

This is a specimen of his writing.

While writing this his eyelids were both drooping and the left eye was practically shut so that he saw with the right eye alone. All the time his eyebrows were raised and constantly twitched up and down and his forehead was greatly wrinkled.

Patient states that he has never been an excitable or nervous man - except that he has been more irritable since the trouble with his eyes started - and he informed me without my asking him that he has never been given to "fears."

If while patient is "struggling" to open his eyes - with his mouth open and his head moving jerkily -; a question is asked him sharply, he immediately opens his eyes, closes his mouth /
mouth /
and steadies his head.

He has found that by contracting the muscles of his hands or arms firmly he can more readily open his eyes or keep them open.
N. B. In the history of previous illnesses, family history and physical examination, the more significant passages are indicated in the margin by a red line and the less important passages are inset.

PREVIOUS ILLNESSES AND ACCIDENTS.

Group.
Measles.
Mumps.
"Gastric Fever".

Catarrh of the stomach, preceded for some months by indigestion, when 20 years of age. Patient was off work for 9 months at this time.

Thrown from a mule while in the Army in France, 1917. Patient was in a Field Hospital for 10 days after this accident and received massage treatment for his spine which was the part injured by his fall. The skin wasn't broken and although there was pain in the part for some time afterwards patient hasn't felt any discomfort in the spine for a long time now.

In April and May 1918 patient was in hospital for about a month. The diagnosis of his complaint was first trench fever, afterwards myalgia and finally "P. U. O." After a rest in a convalescent camp he returned to the base and almost immediately took influenza and was sent to hospital for 10 days or so and to a convalescent camp for a fortnight.

In August 1922 while patient was away for his holiday he developed a fairly severe attack of frontal sinus catarrh. He forgets over which eyebrow the pain was present /
but his description of the pain which showed periodic exacerbations and was associated with copious discharge from time to time from the nostrils and passing down the throat, as well as with fever and malaise make the diagnosis pretty certain.

In July 1923 he had a number of blisters - about a dozen - on the private parts. These blisters itched a little but were not painful and they exudated a turbid material and scabbed over. Patient's doctor said it was an attack of shingles and that it would soon pass away. In three weeks after they first appeared the blisters had all disappeared.

GENERAL SURROUNDINGS AT HOME AND AT WORK.

Patient likes very much the house he is living in at present and his work altho' not full time, and therefore not so remunerative as he would like, is congenial to him and what he has been accustomed to all his life.

He states that he has no domestic worries beyond those that arise from his recent unemployment.

He takes his meals regularly now altho' when he was out of work last winter he never felt ready for his meals partly due to the anxiety of his finances and partly to the inactive life he had to live.
He is a moderate drinker. When he first discovered the difficulty of vision he stopped all drink, but recently he has begun to take stout to try to increase his weight.

Patient states that his neighbours and the people he works with are very agreeable and that he "gets on well" with everyone.

FAMILY.
Father. Went abroad when patient was young and has never been heard of since.
Mother. Died comparatively young and age and cause aren't known to patient.
Brothers. None.
Sisters. Two. Died in childhood - cause not known to patient.

Patient was brought up by his father's relatives who are all healthy people who have no chronic illnesses, no "nervous trouble" and no "consumption", according to patient's statement. He knows less of his mother's family but states that those members of it whom he has met seem to be quite healthy. He is quite sure that none of his relatives has had any trouble at all like his own.

Patient's wife (who is 37 years of age) is quite a healthy woman and has had no miscarriages.

Patient has had 3 children two of whom are alive and well namely a girl of 3½ and a boy of 5 months. The first born died of meningitis when a few months old.
STATE ON EXAMINATION.

Intelligence - Above the average of hospital patients.
Height - 5 ft. 5½ ins.
Weight - 9 st. 9 lbs.

Development - Good.
Muscularity - Good, but patient states that it is reduced since May 1923.

GENERAL APPEARANCE AND EXPRESSION OF THE FACE.

Patient's face is pale and rather sallow and very wrinkled. There are four deep parallel furrows stretching right across the forehead and, in addition, a separate furrow over each eyebrow. There are three vertical lines at the glabella and continued above and below it and many fine lines round the eyelids. The eyelids themselves show, when the eyes are open to the normal extent, very many folds as though the skin, at least, is excessive in amount or stretched. The nasojugal fold and lines round the mouth are well marked and numerous.

Altho' so much furrowed patient hardly looks his age, which is 46.

Temperature - 97.2°F.
NERVOUS SYSTEM.

Intelligence - Average for his class and occupation of a clerk.

Emotional state - Nothing to note at present.

Patient is neither excitable nor depressed and shows anxiety to be cured and an unnaturally great and rather childish interest in his unusual condition.

Memory - good and patient is very consistent in repeating the same details on different days.

Hallucinations and Delusions. There is no evidence of these, and as recorded in the personal history, patient states that he is quite pleased with the surroundings in which he lives and works, that his family life is happy and that he lives at peace and in mutual esteem with his neighbours and other people with whom he comes into contact.

Fits. On being questioned as to the occurrence of symptoms common in fits patient said that nothing of the kind had ever occurred to him.

Speech, articulation and phonation show no abnormality.

Cranial Nerves.

I. Smell. Unimpaired sense of smell in both nostrils. No parosmia.

II. Patient requires glasses for reading and writing, but not for distant vision.

Eye-grounds normal by ophthalmoscopic examination.

III.) As described in the history patient's complaint.

IV.) centres round ptosis of his eyelids and tonic and clonic contractions of them. As recorded this varies greatly from time to time and is sometimes not present at all.
No squint nor diplopia.
No nystagmus.
The pupils are regular in shape, equal in size and react to light by direct and consensual tests, and react to accommodation.

V. Motor power of muscles supplied by V. is good.

Sensory functions of V are unimpaired.

VII. Facial muscles show no loss of power.

The complaint of closure of the eyelids doesn't seem to involve the orbicularis oculi, only the levator palpebrae superioris - for the orbicularis oculi can be immediately relaxed when required, the frontalis muscles contract and only the levator palpebrae superioris fails to act.

VIII. Hearing is normally good and there is nothing else to note.

IX. Nothing to note.

X. Palate movements are good.

XI. Sterno mastoids and trapezius have full power.

XII. Tongue movements are unimpaired.

Cervical Sympathetic.

Pupils dilate to shade.

Eyeballs are a little more prominent than usual, but not amounting to definite exophthalmos.

No enophthalmos.

No flushings or sweating of head, neck or upper limb.

Motor functions.

No abnormal movements except that complained of in the case of the eyelids.

Except for the eyelids the muscles show nothing to note - their tone is good and they contract and react readily.

There is no inco-ordination and no Rombergism.
Reflexes.

Superficial.
Conjunctival - present on both sides.
Pharyngeal - present.
Abdominal - well marked on both sides.
Plantar - flexor response on both sides.

Deep.
Wrist - present on both sides.
Elbow - ditto.
Knee - very active on both sides - especially on the left side.
Knee Clonus - present to a small extent on the left side and to a very slight extent on the right side.
Ankle jerk - present to a less extent than normal on left side and to the normal extent on the right side.
Ankle clonus - present to a slight extent on the left side and absent on the right side.

Organic - Nothing to note.

Sensory Functions.
No abnormal subjective sensations.
Slight headache just over the eyebrows, not very severe in character and intermittent.
No vertigo.
No disturbances in the objective sensory powers as to touch, pain, heat, cold.

Vasomotor and Trophic Functions.
Nothing to note.
Locomotory System.

Bones - Nothing to note.

Joints - Nothing to note.

Muscles - Except the levatores palpebrarum superiorum the muscles show no abnormality.
ALIMENTARY SYSTEM.

No abnormal subjective phenomena while in hospital.

Lips - Good colour, and nothing to note.

Teeth - Upper jaw - A denture takes the place of all the upper jaw teeth except the 2nd right molar which is discoloured but not decayed.

Lower jaw - On the left side the 2nd premolar and 1st molar are not present, and the others are discoloured and healthy. On the right side the 1st premolar is a stump, the 2nd premolar and 1st molar are not present and others are discoloured but healthy.

Secretions of the mouth are healthy at present.

State of bowels - regular, and nothing else to note.

Abdomen. Inspection. Well rounded abdomen with good muscles and no abnormal prominences or retractions. Moves freely on respiration.

Palpation. No tenderness on superficial or deep palpation.

Border of liver, border of spleen and kidneys not palpable.

Percussion - Nothing to note.

In midclavicular line upper border of the liver is at the 4th interspace and the lower border is just above the costal margin.

The stomach by percussion and auscultatory percussion is small and the greater curvature reaches to about $3\frac{3}{4}$" above the level of the umbilicus at a point $2\frac{1}{2}$" to left of the median plane.
HAEMOPOIETIC SYSTEM.

No subjective phenomena.

Some enlarged glands - soft and varying in size from large shot to a pea - are present in the posterior triangles of the neck - more on the right side than the left.

No enlarged glands in axillae or groins.

Blood - R. b. c. 5,200,000
W. b. c. 10,200
{ Polymorphs 64%
 { Lymphocytes 32%
 { Eosinophils 4%

Hb 75%
CI .74.
CIRCULATORY SYSTEM.

No abnormal subjective phenomena referable to this system.

Pulse. Arterial wall is soft and elastic.
Frequency is 72 per minute.
Regular in time and force.
Upstroke well felt and normal in extent. Downstroke normally slow.
Pressure - Systolic 118.
Diastolic 85.

Heart. Inspection. Of precordial region -
No pulsation seen, and no extracardial pulsation except a slight venous fluttering pulsation in the neck above the right sterno clavicular joint.

Palpation - Apex beat not felt.

Percussion - Left border \( \frac{1}{2} \)" to left of sternum.
Apex at 5th costal cartilage 3" from mid line of sternum.

Auscultation - First and second sounds pure and closed in all areas. No abnormal sounds.
RESPIRATORY SYSTEM.
No abnormal subjective phenomena referable to this system.
Breathing - 20 respirations per minute, abdomino-thoracic in type. Regular rhythm.
Nares - Patient states that he often has attacks of running at the nose with a copious watery discharge.

Thorax. **Inspection.** The chest is of rather a broad type and shows no deformities. The movements are of normal extent and equal on the two sides.
**Palpation.** This method confirms the observations on movements made by inspection. Vocal fremitus is normal.
**Percussion.** The percussion note is normally resonant except for some impairment at both apices.
**Auscultation.** Breath sounds are vesicular in all parts except the right apex where they are broncho-vesicular.
There are no accompaniments.
Vocal resonance is normal.

Integumentary System.
No abnormal subjective phenomena.
Nothing to note in the state of the skin.

Urinary System.
No abnormal subjective phenomena.
Frequency of micturition - 4 to 5 times during the day time and no times at night.
Urine. **Reaction - Acid.**
**Specific Gravity - 1016.**
Urine (continued) Deposit - mucus.

Colour - Amber.

Albumin - ve Blood - ve Pus - ve
Sugar - ve Bile - ve.

Reproductive System.

Nothing to note.
DIAGNOSIS. - Tic affecting the muscles of the eyelids.

The diagnosis of tic is based on the apparently erratic occurrence of the symptom, the recovery of control over the eyelids when the patient's attention is diverted from them, the solemn and concentrated, almost pleasurable, interest which the patient takes in experimenting with his condition as he lies in bed and the absence of any evident cause of reflex irritation, but (what is quite significant) his eyes have always been sensitive to sun and wind and needed protection from them.

The differential diagnosis will be considered with the commentary of the case.
TREATMENT.

For the first 3 weeks patient was kept in bed and various practices and exercises were carried out to try to regain for him control over the affected muscles. It was his over-serious application to these methods in a large ward of patients which gave the biggest hint of that mental infantilism that is so important a factor in diagnosis.

To show the patient that improvement was possible and likely, he was encouraged at first to aid his control over the eyelids by contracting his hand and arm muscles (as he had done already) and also his legs because then his hands would be free to write. These devices brought considerable success.

Then the re-education method was started and patient lay in bed without moving the head and slowly and steadily allowed his gaze to travel vertically up and down the opposite wall. Improvement occurred for some time and he could read and write more easily but possibly for lack of sufficient perseverance real cure was not achieved and the patient left hospital after six weeks only partially relieved.
DIFFERENTIAL DIAGNOSIS AND COMMENTARY.

The conditions which need to be considered in differential diagnosis include:

1. Myotonia (Thomsen's disease).
2. Ptosis.
3. Contracture of the Eyelids.
4. Hysteria.
5. Spasm.
6. Stereotyped act or trick.

1. The distinction from Thomsen's disease is interesting in view of one of the other cases in this series and is not difficult. The resemblance between the two conditions is very great when the patients are seen struggling to open the eyes but a few tests soon show the difference. In the case of tic the eyes are held half shut for long periods (sometimes for hours); the effort to open them may be immediately successful when danger threatens the patient or when his attention is otherwise strongly attracted, and when the eyelids are drooping they can be readily lifted by the fingers. These features are at variance with those of Thomsen's disease and on the other hand there is never in the case of tic a marked improvement at each successive effort to open the eyes.

2. Ptosis due to a lesion in the path or nucleus of the third cranial nerve might easily be suspected when the patient was seen walking with his eyes almost closed, his eyebrows raised and his head tilted backwards, but the alacrity with which the eyeballs could be fully exposed on occasion and even maintained so for long periods (as when he assisted in managing a delirious
patient is sufficient to make the differentiation.

3. Contracture of the tissues of the eyelids or neighbouring tissues can be dismissed as a diagnosis on similar grounds.

4. In considering *hysteria* we are on difficult ground because the all devouring psycho-analysts consider *tics* as one rather insignificant section of the manifestations of conversion *hysteria* (1). Since no attempt was made to psycho-analyse the patient this matter cannot be fully discussed here, but no sensory disturbances were found during the physical examination, all the normal reflexes were present and were unusually active in the lower limbs, there was no history of fits and no stigmata of degeneration noted. It must be admitted however that the coincidence of the onset of the symptoms with his employment and the end of his "enjoyment" of unemployed pay might be used as an argument for a diagnosis of *hysteria*; or alternatively that his anxiety to perform his work well led to the same result. And altho' Meigs and Feindel's book was written in the pre-psycho-analytical era, they describe *tic* as a psychical defect in a physical guise, which seems to foreshadow the modern psychiatrists' view.

5. A *spasm* is defined as the motor reaction consequent on stimulation of some point in a reflex spinal or bulbo-spinal arc and the irritation provocative of the spasm is in itself of pathological origin, and no spasm can occur without it. (2). In a *tic*, on the other hand, the cortex intervenes to order the repetition of the gesture provoked involuntarily in the first instance by peripheral excitation. In our case no pain occurred so /
so that the form of spasm known unfortunately as "tic douloureux" can be at once excluded. Although no obvious source of pathological peripheral stimulation was found in the eyes, conjunctival sac or about the face the possibility of some such focus existing in, say, the teeth etc. etc. can never be denied. On the other hand the diagnosis of spasm is made less likely and of tic much more likely by the facts that both eyes are equally involved, that distraction of the attention has a great and immediate effect and that there is present, in previous sensitiveness to light and wind, just that first instance of peripheral excitation characteristic of tic. As further evidence may be added the apparently pleasurable interest of the patient in his condition - what is spoken of as the impulse to seek a sensation.

6. A stereotyped act or trick may closely resemble a tic in its action but has this great difference that it appears most during mental concentration while tics tend to disappear as mental concentration increases in its power. The recorded features of this case, such as freedom from the symptoms at the Parish Council meetings and during business interviews clearly indicate in which category our case should be placed.
COMMENTARY.

Very few medical books contain such an interesting and amazing chapter as that entitled "The Confessions of a Victim to Tic" in Meige and Feindel's volume on "Tics and their Treatment", in which O., the very prince of tiqueurs, describes, ridicules, deplores and explains with clearness, insight and wit the hundreds of bizarre actions by which he had teased himself almost all his life.

How this poor merryandrew was compelled to perform continually for his own brief satisfaction under penalty of his own displeasure and discomfort; how he produced corns on his chin and nose by rubbing them with a cane, and a painful wound on his left ankle by kicking it with his right heel and how he firmly planted new tics in uprooting old ones must all be read, along with much more, to be appreciated. He was a very successful business man, subject to certain oddities in performing his work, and a fond parent, but his mind altho' very acute and analytical was like his body, hasty and discontinuous in its action. He had many phobias and obsessions, his mood was very mercurial, and he hated to be crossed or kept waiting.

The soil in which a tic can grow is a weak will, and the seed is some act or idea which constantly attracts the wayward attention with the result that a certain act or process must be repeated out of place and times out of number. It is believed, although the fact cannot always be ascertained, that a perfectly reasonable act or idea is always the basis of a tic and in our case the need to shelter the eyes from sun and wind seems to be an example.
Tics are seen at any age after 7 or 8 years.

Heredity seems to be a common influence and other factors are stated to be brain fatigue, anguish, anxiety, worry, disappointment etc. In the etiology of individual ticking movements imitation may play an important part.

Tics may be clonic or, as in our case, tonic, and the commonest tics are those that affect the eyelids. The clonic form may be unilateral or bilateral and consists of a palpitation of the upper lid resembling winking in action but differing from it in its frequency and abruptness. Tonic tics may take the form of closure of the palpebral fissure, or, more rarely, excessive gaping of it.

Our case greatly resembled that of a metal polished recorded by Meige and Feindel at page 149 of their book, the chief difference being that their patient was afflicted only, but not always, when he was walking. Like our patient however he could check the spasm in order to avoid obstacles in the street and he was disposed to attribute the trouble "to the action of sun and wind, although he acknowledged the regularity of its occurrence irrespective of either".

Treatment is by the method of re-education and careful exercises of the affected muscles carried out often before a mirror; but it must often fail, in extensive and long lasting cases at any rate, because of the impossibility of satisfying the indication to straighten a will the weakness of which is often congenital.

REFERENCES.
WIGHTMAN PRIZE COMPETITION.

Six Cases
Entered by
J. M. Alston.

Case III. Traumatic Lesion of Cauda Equina.

June 1924.
NAME - DAWSON STEVENSON.
ADDRESS - ASHLEY HOUSE, BRIGHAM, COCKERMOUTH.
Recommended by Dr. Covam, Cockermouth.
Admitted - 11/12/23.
Examined 15/12/23.
Discharged 28/2/24.
Occupation - Miner.

COMPLAINTS.
(1). Pain in right side of back which passed, later, to the right hip. Duration - Since the first week of April 1923.
(2). Pain in left leg and in his "inside" (pointing to abdomen). Lasted from May to July 1923.
(3). "Inflammation of the bladder". Inability to hold water. Lasted from May to November 1923.
(4). When patient passes water, generally the bowels move also. Duration - since November.
(5). A numb feeling down both legs. This started in January 1923 in the sacral region and gradually extended down the legs afterwards.
(6). Cramp first in the right leg and now in the left. Lasted since April 1923.

HISTORY.

Personal.
Since being gassed in 1918, patient's health has not been very good, but during the last year (1922) he could usually work for 4 days a week (as a coal hewer) without straining himself.
In the last week of January of this year patient was lifting a tub, and he slipped so that his sacrum came into violent contact with a piece of iron which projected from the tub. The blow was so severe that patient had to rest for an hour and then he walked home with difficulty. He states that except for the pain he noticed nothing else wrong with him (with his legs, for instance) at that time. Patient rested at home during the remainder of Thursday, the day of the accident, and stayed at home on Friday (part of the time in bed), and on Saturday night he went to his doctor. The doctor gave him something to rub his back with. He returned to work on Monday and Tuesday, but the continued sacral pain prevented his going on Wednesday, when he stayed in bed. He returned on Thursday. After that he continued to work in his usual way of four days a week.

He says that the pain was a dull dragging one which was constantly present during the day, but he was able to sleep at night. Sometimes on changing his position the pain would be very sharp for a short time. It gradually became less and less.

A week or two after the accident patient noticed that as well as the pain in the sacral region there was a dull numb feeling in the same region which extended down both buttocks to just below the gluteal folds. This sensation was more felt on the right side than the left. About the same time patient noticed that he could pinch the skin over the buttocks without feeling it.

After about a month this lack of sensation somewhat decreased and patient could feel the skin being pinched in this area better.
By a month after the accident the pain had passed away from the sacral region, altho' if patient got a blow in that part he felt it much longer than in other regions, and after April the sacral pain again increased to some extent.

Soon after this patient began to work in damp places and used to get very wet.

In the beginning of April 1923 he began to suffer from a severe pain of a sharp, shooting nature in the lower part of the back just to the right side of the middle line. This pain was severe, present all day, often kept the patient from sleeping, and was so acute on walking that he couldn't go to work.

This pain extended, after a week, down the back of the right leg as far as the calf where its severity was least. The pain was sharp and shooting in the leg also and voluntary and passive movements of this leg increased the pain. Patient was confined to bed at this time. This pain in the right leg and right side of the back decreased after 3 weeks or so and then suddenly ceased.

The same day, however, patient for the first time felt a similar pain behind the left knee and this extended upwards to the left buttock. This pain was never very severe and in a few days it decreased.

Patient got up and stayed in the house, when the pain decreased in the right leg, but when it began in the left leg he spent most of the day lying on a sofa. This pain gradually decreased, but patient still has slight occasional attacks of it.

At this time also - about the end of April - patient began to feel a very acute pain in the lower part of the
abdomen in the middle line. This pain was constant and literally doubled the patient up - he got relief only by kneeling on the bed with his head bent as far down as possible. This pain gradually decreased and was not noticed after about July.

Soon patient began to find that he couldn't pass his water himself. He says that Whit Monday (middle of May) was just about the date that this commenced. The doctor catheterized him on two successive days but after that the urine began to dribble away itself. Patient noticed that the water was "thick" about this time and it has been so occasionally since, but not constantly so.

He says he had an abscess in his back just at the place he was struck; it discharged blood and matter twice in one day. This occurred when he first noticed the stoppage of his water. This abscess was pointed out to the doctor at the time, and he said it was "more like an abscess than anything." He cannot remember how long it took to clear up but it has never discharged again, although some pain persisted in the place where the abscess had been. He had no special treatment for the abscess beyond some local application. There is now no sign of the abscess.

The dribbling of the urine continued until about the beginning of November and it would pass with a sudden rush when patient made a quick movement. Altho' he went to urinate often and frequently changed his clothes they were wet from morning to night.

The dribbling decreased about the beginning of November and the position now is that if patient regularly urinates
4 or 5 times a day he has no incontinence as a rule, but occasionally - as this morning when he was sitting on the chair beside his bed - there is a passage of urine of which patient is quite unconscious until he feels himself wet.

For a long time - until quite recently - patient didn't know whether his bladder was full or empty, but now he is beginning to recover his sensation of bladder distension. Sometimes, but not often, there is slight difficulty in starting the act of micturition. Usually the act ends in dribbling.

In May also patient became costive for 4 or 5 days during which time the bowels didn't move altho' patient took a number of different aperients. After these 4 or 5 days diarrhoea suddenly set in, the motions were fluid and patient couldn't control them.

Patient has never had control of the bowels since. A motion occurred every time patient passed water until he came into hospital, but now that colon lavage is done every morning there is not usually a motion at every act of micturition.

There have been frequent cramps, sometimes very painful ones, in the muscles of both inferior extremities, particularly of the hamstrings, calf muscles and muscles of the feet and more on the left side than the right.

Involuntary movements occurred also in the muscles of the shoulders and hands. He sometimes dropped things from his hands. This trembling in different parts of the body began after the accident in January 1923 and began to decrease in severity in August or so and they are now much less than in the earlier part of the year.
Similar tremblings were noticed after patient was gassed in 1918, but there were then no cramps nor jerkings.

Patient has noticed that his feet have been very cold recently and that sometimes he felt his feet no warmer when holding them very close to a fire or a hot water bottle. Again the left foot showed the symptom more than the right.

The legs have got distinctly thinner and weaker altho' he thinks that his body as a whole is only a little thinner than formerly.
N.B. The more significant passages in the previous history, family history and examination are marked by a red line and the less important parts are inset.

**PREVIOUS ILLNESSES AND ACCIDENTS.**

Measles, scarlet fever, whooping cough when a child. At age of 14 the second toe of the left foot was removed at Workington Infirmary because it had been twisted by the wearing of tight clogs. About 1916 patient brought the back of his right hand into violent contact with the roof of the shaft in which he was working and since then he has at times been conscious of a curious numb sensation over the posterior aspect of the 2nd right metacarpal bone and over the radial side of the interphalangeal joint of the right thumb. There has also been a loss of sensation in these parts.

In 1918 patient had a bad carbuncle on the left shoulder and had to go into Preston Infirmary for treatment.

In France in July 1918 patient was gassed and was in hospital for 2 - 3 weeks and at a convalescent camp for 4 - 5 weeks. In hospital his chest and throat felt sore, he was almost blind for a week and his limbs trembled and shook most of the time. He returned to his battery 7 weeks after being gassed but was immediately sent back to the wagon lines where he remained until the Armistice. He was returned home and demobilized on 17th December 1918.

Since /
Since then patient's health hasn't been so good as it formerly was and, as recorded above, he has usually worked about 4 days a week. In 1930 patient strained his right side while lifting a tub and was in bed for a fortnight.

GENERAL SURROUNDINGS AT HOME AND AT WORK.

Patient's house is comfortable and quite suits him. The mine he works in is a good one, but since the War patient has been nervous at his work especially when his mate was away.

His wife left him seven years ago and this with the care of the children has caused him worry and anxiety.

HABITS AS TO FOOD AND DRINK.

Meals are regular and food sufficient. As to drink patient has had very little since the last strike, but before that he was only a moderate drinker and took a few glasses of ale etc. at week-ends or sometimes a glass or two every night.

FAMILY HISTORY.

Father. Alive and well.
Mother. Alive and well.
Brothers. None.
Sisters (4). Alive and well.
Wife. Left 6 or 7 years ago.
Children. 2 Boys - 10 years and 8 years. Alive and well.
STATE ON EXAMINATION.

Intelligence - Average.

Height - 5 ft. 6½ ins.

Weight - 9 st. 3½ lbs.

Development - Good.

Muscularity - Good, except for the legs which have wasted to some extent. General appearance and expression of face - Patient is rather swarthy, with dark deep-set eyes and wears rather a serious expression.

No obvious morbid appearances.

The 2nd toe of the left foot has been amputated at the first interphalangeal joint and has left a very good stump.

Temperature - 96.8°F.
Nervous System.

Intelligence - Average.

Emotional State - Nothing to note.

Memory - Good.

No hallucinations nor delusions.

Sleep - Good.

No delirium, coma, nor fits.

Speech, articulation and phonation - nothing to note.

Right-handed.

Cranial Nerves.

Ist. Sense of smell - good in both nostrils. No parosmia.

IIInd. Visual acuity good in both eyes. Fields of vision unrestricted in both eyes. Ophthalmoscopic examination - Both discs normal.

IIInd. Ocular Movements good and equal in both eyes.

IVth. Slight degree of nystagmus when looking to extreme left or right - more when looking to right, Patient says that miners' nystagmus is common in his district especially during the War when the electric lights used were bad. He once had nystagmus for a short time himself but it passed off and now he isn't troubled with it.

No ptosis; no diplopia.

Pupils - equal, regular in shape and react to light by direct and consensual tests and on accommodation.

Vth. Motor - nothing to note.

Sensory - nothing to note.

Taste - nothing to note.

VIIth. Motor - nothing to note.

No hyperacusis.
VIIIth. Hearing good in both ears.
  Watch heard at about same distance as I can hear it.
  Rinne's test - Air conducted sound heard better than
  bone conducted in both ears.
  Weber's test - Vibrations of tuning fork held on
  forehead are heard equally well in the two ears.
  No vertigo. No otorrhoea.
  Otoscopic examination negative.

IXth. Nothing to note.

Xth.

XIth.) Nothing to note.

XIIth)

Cervical Sympatetic.
  Pupils dilate to shade.
  Cilio-spinal reflex not elicited.
  No proptosis.
  No exophthalmos nor enophthalmos.
  No excessive sweating of head or neck.

Motor Functions.
  As recorded in the history patient had a considerable
  amount of tremor, jerking and cramp in the muscles of the
  calves, thighs, buttocks, shoulders and hands and more marked
  on the left side.
  Occasionally this occurs to some extent since admission,
  as on the evening of 20/12/23 when a fairly regular tremor
  in all limbs and the trunk, neither very fine nor very coarse
  in character occurred for about an hour.
  Muscular power of superior extremities, thoracic and
abdominal wall and inferior extremities is very good, and except in the case of the hands is approximately equal on the two sides.

In the right hand there is a little permanent flexion of the fingers especially the ring finger and flexion and adduction of the thumb – due to grasping of the pick-axe firmly at work.

With the hand dynamometer patient registers 120 lbs. with the right hand and 92 lbs. with the left. This difference between the power of the two hands is evident when patient grips my fingers and he says that he has always known that his right hand is the stronger, but his left has got rather weaker he thinks since his accident in January and particularly since he has been lying in bed.

The upper arm muscles seem to be equally strong on the two sides.

When the thigh muscles contract powerfully they sometimes show fibrillary tremors.

The sphincter muscles of the ano are very weak and patient cannot grip the finger placed within the ano at all tightly.

Coordination is unimpaired in upper and lower extremities. No intention tremor of hands; no Rombergism.

Reflexes.

Superficial.

Conjunctival - present on both sides.

Palatal –

Abdominal – present on left side, absent on right.

Plantar – weak extensor response on both sides.

Anal – weakly elicited.

Bulbo-cavernosus – absent.
DEEP.

Wrist - active on both sides, and increased on right side.
Elbow - As wrist.
Knee - Increased on both sides.
   Clonus on right side; doubtful clonus on left.
Ankle jerks - barely present.
   No clonus.

ORGANIC.

At present there is only occasional incontinence of urine as explained in the history. Sensation of distension of the bladder is also returning. The act of micturition can be started at once now, but ends in hesitancy and dribbling. Defaecation does not trouble the patient now because he gets lavage of the colon every morning and doesn't need a motion of the bowels afterwards during the day. He is troubled by the passage of flatus which he can't control.

SENSORY FUNCTIONS.

Patient complains of a constant dragging feeling which isn't actually painful in the perineal region, also of numbness in the perineum, buttocks and the backs of the thighs.

No headache, nor vertigo.

OBJECTIVE PHENOMENA.

(A). Touch. Unimpaired except

(1). Anaesthesia to light touch in perineum, scrotum, penis, medial half of both buttocks and one third of way down back of thigh nearer inner side.
Patient does not feel palpation in the anus and rectum.
(2). Some anaesthesia to light touch on the lateral half of the left foot and also (in less degree) on right foot in the corresponding region.

(B). Pain. Unimpaired except -

(1). In perineum, scrotum and penis neither a prick with a pin nor a firm pinch is felt; and on the medial part of the buttocks and for a short distance down the back of the thighs, a prick is usually called blunt pressure, and a firm pinch is called a light one.

(2). On the lateral half of the left foot a pin prick is usually called blunt. On right foot in the same region there is no observable decrease of pain sensation.

(C). Pressure. Unimpaired except -

(1) In perineum, scrotum, penis, medial half of buttocks, upper third of back of thigh near inner side where firm pressure is barely felt or called light pressure.

(2). On outer side of left foot where firm pressure is called light pressure and in corresponding part of right foot where pressure is not fully realised.

(D). Heat and Cold. Unimpaired except -

(1). In perineum, inner parts of buttocks etc. where neither heat nor cold is felt. In outer parts of the buttocks and upper parts of back of thighs heat and cold are confused and usually heat is called cold.

(2). In the lateral half of the left foot sometimes there is no response and sometimes there is confusion - usually cold being called hot. In the right foot in the corresponding region there is less impairment which consists in only occasional confusion.
(E). Localisation of sense of touch.

Unimpaired except at points where there is complete anaesthesia.

(F). Vibration sense (tuning-fork).

Unimpaired in bones of head, trunk, and arms.

Uncertain at:

- Ant. sup. iliac spines (right and left).
- Gtr. trochanters (right and left).
- Condyles of femur (left only).
- Patella (left only).
- Tibia tuberosity and int. malleolus (left only).
- Fibula head and ext. malleolus (left only).
- Tarsal bones (left only).
- Metatarsal bones, especially 3rd - 5th. (right and left).

(G). Joint sense.

Unimpaired in upper extremities. Not very accurate in lower extremities, especially on right side.

(H). Sense of active muscular contraction.

(Kinaesthetic sense).

Unimpaired in arms and legs as tested by balls of different weights.

(I). Stereognostic sense.

Unimpaired in hands.

Cerebro-spinal fluid. No fluid was withdrawn in attempts to remove it at three different levels.

Vasomotor and Trophic Functions.

Feet are cold as recorded in history and left is more so than the right. Also when asked if one part is colder than another he says that the outer part corresponding to the 2 outer toes is coldest. Right foot is equally cold in all parts.
LOCOMOTORY SYSTEM.

X-ray examination shows a very low 5th lumbar vertebra which is causing distortion of the sacrum - a condition of spondylolisthesis - so that the long axis of the sacrum is much more horizontal than usual and therefore the long axes of the lumbar and sacral portions of the spinal column are much more inclined in regard to each other.

Apparent changes in bone sensation have been already noted but no other bone changes such as spina bifida occulta, were found.

JOINTS. Slight pains occur at times in the hip joints both on movement and at rest. The action of all the joints was free according to their natural extent.

MUSCLES. Muscle tone in general is not so good as when patient is well and at work but except for the legs there is very good muscular power everywhere.

In the legs and especially in the left thigh muscular development is less than in the rest of the body and patient himself thinks that his legs have got thinner, but no weakness of any of the lower limb muscles could be detected and when the patient came into hospital he was able to walk perfectly well and without tiring his legs.

Measurements of the thighs (at 15 cm. above the patella) were:

Right - 41.25 cm.

Left - 38.75 cm.,

showing a difference of 1.5 cm. or \( \frac{3}{5} \) inch.

Tremors, jerkings and cramps in the inferior extremities, trunk, shoulders and hands are recorded in the history.
REPRODUCTIVE SYSTEM.

There have been no erections since the beginning of 1923 and patient says that there is much "less life" in the private parts than before the illness. He says he has had no nocturnal emissions since the illness.

There are no signs of scars on the penis.

ALIMENTARY SYSTEM.

Subjective sensations. Appetite good and unchanged. Thirst - normal.

No other subjective sensations to note.

Lips. A little blue, but patient says that his face and head feel cold as the weather is very bitter.

Teeth. Lower jaw - Right side. Incisors and canine good.
1st premolar good.
2nd premolar absent.
1st molar decayed and stopping has broken.
2nd molar whole but dirty.
3rd molar absent.

Left side - Incisors and canine good.
Premolars good.
1st molar whole but dirty.
2nd and 3rd molars absent.

Upper jaw - Right side - Incisors and canine good.
1st premolar good.
2nd premolar absent.
1st and 2nd molars whole but dirty.
3rd molar absent.
Left side - Incisors and canine good.
1st premolar good but dirty.
2nd premolar broken to a stump, barely showing through the gum.
1st and 2nd molars good but dirty.
3rd molar absent.

Patient states that he sometimes has a sweetish sickly taste in his mouth. This is probably due in great part at any rate to the decay of the 1st lower left molar.

The gums of the upper jaw are of good colour and healthy in appearance.

The gums of the lower jaw are irregular in outline and broken especially opposite the incisor and canine teeth. They are bluish just below the margin at this part and in one or two places beads of pus are seen at the margin.

Tongue is firm and moist and considerably furred.

Fauces and posterior pharyngeal wall show nothing to note. Tonsils are small and pale.

State of Bowels. Patient has a colon lavage every morning in hospital and after that he passes nothing by the bowel except wind over which he has no control.

ABDOMEN.

Inspection.

Muscular but not fat abdominal wall. No prominences, no retraction. Respiratory movements good and equal.
Palpation.

As a whole the patient does not relax his abdominal muscles very well and there is quite distinct rigidity of the recti in and about the middle line 2 fingers breadth above pubes.

There is no tenderness except at this same place, where the tenderness extends for 2" or so, but is not very acute.

The lower border of the liver can't be palpated nor the spleen nor either kidney.

Percussion.

In mid clavicular line the upper border of liver is at the level of 4th r.c.b. and lower border is ½" above costal margin.

By percussion the borders of the stomach cannot be defined possibly because the intestines and stomach are somewhat distended by gas. By auscultatory percussion the lower border of the stomach reaches a point 3" above the level of the umbilicus and 1½" to left of median plane and the right border does not reach the median plane by an inch or so.

The bladder dullness reaches halfway to the umbilicus.

Elsewhere the note of large and small intestine is uniformly tympanitic.

HAEMOPOIETIC SYSTEM.

No subjective phenomena.

No enlarged glands in neck, axillae or groins.

Thyroid gland rather small but normally soft on
palpation.

Blood. R. b. c. 5,100,000.
(Polymorphs 74%)
W. b. c. 7,600 (Lymphocytes 23%)
(Eosinophils 3%)
Hb. 95%
C. I. .93
Wassermann test - Negative.

CIRCULATORY SYSTEM.

No subjective phenomena.
Pulse. Arterial wall is perfectly soft and elastic.
Pulse is regular in time and force. Upstroke good and normally well sustained. Downstroke normally slow.
Time 80 per minute.
Pressure - Systolic 114 mm.

Diastolic 70 mm.

Heart: Inspection. of precordia. Nothing to note.
No extracordial pulsations.
No apex beat visible.

Palpation.

No extracordial pulsations.
Apex beat, not strongly felt, is in 5th left intercostal space 3½" or 4" from middle line.

Percussion.

Right border is not outside right border of sternum.
Left border is at normal position at different levels.

Auscultation.

Sounds are not well heard in any area, but are all
closed and pure. The first sound at mitral and aortic regions is particularly weak.

RESPIRATORY SYSTEM.

Subjective Phenomena. Patient has a slight coryza at present, but has usually no symptoms referable to this system.

Breathing. - 20 respirations per minute.

Abdomino-thoracic in type.

Thorax - Inspection.

A long but not narrow thorax with slight indications of a Harrison's sulcus but no other irregularity.

Respiratory movements - Slightly decreased expansion on the left side of the chest.

Palpation.

Movements - Less on left side of chest.

Vocal fremitus less at left side of upper part of thorax than at corresponding spot on the other side.

Percussion.

Nothing to note.

Auscultation.

Vesicular breathing heard everywhere; rather faint on left side in front.

Tidal percussion normal at apices and bases.
X-Ray Examination of Thorax.

Slight root mottling (more marked on the right side); the apices do not illuminate well and the diaphragm movements are good.

INTEGUMENTARY SYSTEM.

Subjective Phenomena. - Numbness and tingling in perineal region, buttocks, back of thighs, dorsum of right hand as described in the history. These sensations are not constant, and are less frequently felt now than formerly.

There is a number of papules and macules on the back, mostly in the scapular region. Above the right scapula there is a dark brown naevus.

Just below the inferior angle of the left scapula there is in the skin tissues a firm tumour of the consistence of india-rubber. The skin cannot be raised from this tumour, but it can be lifted away from the subcutaneous tissues with the skin.

There is no sign of a scar over this tumour although patient says he thinks this is the position of the carbuncle referred to in the history. The tumour is probably a skin cyst perhaps of the nature of a corn.

URINARY SYSTEM.

Subjective phenomena.

Patient states that since January he has had occasional pain in the left kidney angle and radiating along the last rib to the
front of the abdomen and sometimes down the leg more often on the inner than the outer side. He has never noticed any shivering at the time of the pain. The pain isn't very severe and is not stabbing in character but dull. There is tenderness in this region.

Apart from the pain which followed in the left side after the accident in 1920 (recorded in the history) patient has had no pain in the left loin or kidney region.

At present patient is incontinent only at intervals (as recorded in the history) and urinates about 5 or 6 times a day.

The act of micturition can be readily started now (altho' recently there was difficulty in starting the act) and most of the urine comes away readily. Towards the end of the act however the stream stops and patient must wait for a short time for it to start again. The act ends in dribbling.

There is no pain associated with the act.

Amount - Not recorded because it is not all kept to be measured.

Reaction - Acid.
Specific Gravity - 1014.
Colour - straw.
Deposit - mucus.
Albumin -ve.
Blood -ve.
Pus -ve.
Sugar -ve.
Bile -ve.
PROGRESS NOTES.

31st December 1923.

For the last few days patient has felt at intervals a cramping pain in the back of thighs and calves on both sides but more on the left side. This pain had been present before, as recorded in the history, but had improved until it was only occasionally felt. At the same time there has been a recurrence of a tight feeling in the tendons behind the left knee and in the left calf and to a less degree in the left hamstrings. This stiffness of the hamstrings and calf muscles varies from time to time and when it is worst his legs feel as if they would give way under him.

He says that the soreness in the sacral region, where the blow was received in January last, has never quite disappeared and is worst when he rises after being seated for some time.

19th February 1924.

The pains in the legs are only occasional and less severe than formerly. Patient can walk without pain or tiredness. The anaesthesia in the saddle area, buttocks, back of the thighs and on the feet has all decreased.

There is still imperfect control of the rectum but only rare incontinence of urine.

This improved condition was the state on discharge.

During his time in hospital he lost 7 lbs. in weight, but when he left he felt fairly strong.
RESUME OF HISTORY.

End of January 1923. Accident to sacral region.

For the following fortnight there was a decreasing dragging pain at the site of the blow only.

About middle of February - Dull numb feeling began in sacral region and both buttocks (more in right) and insensitiveness to pinching in same areas.

About middle of March - Numbness and insensitiveness much decreased.

No sacral pain; only sensitive to extra pressure or blow in that area.

Beginning of April - Severe shooting pain in lower part of back to right of mid line, which extended after a week down back of right leg to the knee. Patient in bed.

End of April. Above pain decreased and suddenly ceased.

Same day a similar less severe pain occurred behind left knee and extended up to left buttock but soon decreased.

Very acute pain in lower abdomen which decreased but continued until July.

About middle of May - Retention of urine for 2 days, followed by dribbling incontinence and loss of bladder sensation. This all improved and in December sensation is now present and control fairly good.

Constipation for 4 or 5 days followed by diarrhoea and loss of anal control, which has never returned altho' in hospital colon
lavage masks this defect.
Twitchings and cramps of lower limbs especially the left.
Coldness of feet with noted anaesthesia to heat especially on outer half of left foot.
Abscess in sacral region, where blow was originally received.

TREATMENT.

Colon lavage daily.
Potassium iodide up to 30 grains t. i. d.
Aspirin, 10 grains, for the pains in the legs.
CLASSIFICATION OF SYMPTOMS AND SIGNS AND THEIR COURSE.

1. **Subjective Pain.**

   (a). The pain due to contusion of the sacral area disappeared in about a month after the accident.

   (b). Shooting pain in the right side of the back at the level of the sacrum extending to the right knee lasted the whole of the month of April and suddenly disappeared.

   (c). A similar pain began in back of left knee at end of April and after extending up to left buttock disappeared in a few days.

   (d). Very acute pains in the lower abdomen occurred at intervals between the end of March and July.

   (e). At examination in December, patient complained of dragging, almost painful sensations in the perineum.

   (f). Occasional cramp like pains in the back of the thighs.

2. **Changes of Sensation.**

   (a). During February patient noticed numb feelings and loss of sensation to touch and pinching in the sacral and buttock regions but this sensory loss greatly decreased after a month's duration.

   (b). At examination in December patient complained of numbness in the perineum, buttocks and back of the thighs, and also of loss of sense of heat on the outer part of the dorsum of the feet.

   (c). On objective examination there was loss of sense of light touch on the perineum, scrotum, penis, medial half of both buttocks, one-third of the way down the back of the thighs nearer the median side; in the anus
and rectum; and on the lateral half of the dorsum of the feet especially on the left.

This form of anaesthesia was recovered from to a certain extent in the buttocks, thighs and feet.

(d) Pain as tested by pricking with a pin and by pinching the skin firmly was not felt in the perineum, scrotum, penis, medial part of buttocks, upper and medial part of back of the thighs and on the lateral part of the dorsum of the left foot (only).

This form of anaesthesia also decreased.

(e) Deep pressure with a blunt instrument was not felt at all in the perineum, scrotum, penis or round the anus and was called pressure in the medial part of the buttocks, medial and upper part of the thighs and on the lateral part of the dorsum of both feet.

(f) Heat and cold are not perceived in the perineum, scrotum, penis and round the anus, and are often confused on the medial half of the buttocks, upper medial part of the thighs and on the lateral half of the dorsum of the feet, especially the left.

(g) Apparent diminution of vibration sense (compared with the rest of the body) at most of the bony points in the lower limbs, especially the left.

3. Changes in Reflexes.

Anal - weakly elicited.
Bulbo-cavernosus - absent.
Knee-jerk - increased on both sides.
Knee clonus - present on right side; doubtful on left side.
Ankle jerks - barely present on both sides.
Plantar - weak extensor response on both sides.

Organic - Micturition. Incontinence partly of the overflow type and partly of the dribbling type. Much improved.

Defaecation - Paralysis of sphincters of anus.


Paralysis of anal sphincters and of bladder. The former loss of power remains, but the latter is much improved.

5. Changes in Reproductive System.

Decrease of activity as noted in the history.
From L. R. Müller's "Untersuchungen über die Anatomie und Pathologie des unteren Rückenmarksabschnittes."

Fig I
Anesthesia in lesion at level of 1st Sacral Segment.

Fig II
Anesthesia at lesional level of 2nd Sacral Segment.

Fig III
Sensory distribution of spinal segments in lower limbs (after Seffer.)

This diagram illustrates exactly the anesthesia in our patient.
From Dejeure et André Thomas "Maladies de la Nodle Espinière" p. 185:

Showing the relations of the cones medullaires and cauda equina to the vertebrae.

From Dejeure et André Thomas loc cit. p. 234

Sensory distribution in lower limbs (after Kocher)

Fig. VI
Sensory Distribution in the Lower Limbs.

Fig. VII.
Accounts and diagrams of the skin areas supplied by the segments of the spinal cord vary to a considerable extent, but as a glance at the diagrams reproduced on the next page will show, the areas of skin of our patient in which there are changes of sensation are regarded by most observers as being represented in the 2nd, 3rd, 4th and 5th (and according to some the 1st) sacral and the coccygeal segments. The areas affected correspond very closely indeed to those which Muller shows in an illustration of a lesion at the level of the 2nd sacral segment, but in attempts to localise lesions exactly and to compile "accurate" charts of segmental distribution it must be remembered that individual variations (as in the case of blood vessels etc.) are likely and probable, and that partial lesions of a segment will lead to confusion since the exact amount of damage is not and cannot be recognised even at post-mortem examination.

Although the patient considered that his legs were not so powerful as before the illness, no paresis could be discovered in any muscle of the lower limbs. On the other hand there have been frequent cramps, sometimes very painful, in the muscles of both inferior extremities, particularly of the hamstrings, calf muscles and muscles of the feet and more on the left side than the right. In all these areas the nerve supply of the muscles is, at least partly, from 1st, 2nd or 3rd sacral segments (2) and the cramps are due to an irritation of the cord in those areas or in the nerve paths which emerge from them.

The motor centre for the bladder musculature, rectum and anal sphincters which were paralysed in this case is usually placed in the 3rd and 4th and 5th sacral segments.
The centre for erection (the power of which is much lessened or lost) is the 3rd sacral segments and for ejaculation there are said to be two centres – one in the 1st and 2nd lumbar segments and the other in the 3rd sacral. (3).

The spinal cord centres of the reflexes which were found changed are shown in a table.

<table>
<thead>
<tr>
<th>Reflex</th>
<th>State on Examination.</th>
<th>Level of Cord Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee Jerk</td>
<td>Increased on both sides.</td>
<td>L(2)3,4.</td>
</tr>
<tr>
<td>Ankle jerk</td>
<td>Barely present</td>
<td>L 5, S 1,2.</td>
</tr>
<tr>
<td>Bulbo-cavernos-us</td>
<td>Absent.</td>
<td>S3.</td>
</tr>
<tr>
<td>Plantar.</td>
<td>Weak extensor response</td>
<td>L5, S1,2.</td>
</tr>
</tbody>
</table>

These results indicate that there is an increased irritability of the reflex paths of the knee jerk passing through the (2nd) 3rd, and 4th lumbar segments and a decreased irritability or destructive lesion in some or all of the reflex paths which pass through the segments 5th lumbar to coccygeal inclusive.

Summing up the evidence of sensory, motor and reflex functions we must suppose lesions in the following segments or/and in the afferent or efferent nerve paths connected with them –

From the evidence of sensory functions – S1?, S2, S3, S4, S5,Co.  
" " " " motor " " S3, S4, S5.  
" " " " reflex " " L2-4 L5, S1, S2, S3, S5,Co.  
" " " all 3 functions " L2-5, S1-5, Co.

It will be noticed that the only evidence of the involvement of the 2nd – 4th lumbar segments and their connections is the
increase of the knee jerks and that the muscles which receive their nerve supply from these segments are not affected, nor are the sensory functions of the segments altered; therefore it is reasonable to claim that the change in the knee jerks is due to a hyperexcitability of their centres brought about by the presence of the definite lesion lower down in the cord and for our purposes the 2nd - 4th lumbar segments must be exculpated. In the case of the 5th lumbar segment, there is no evidence of damage to it from the sensory side and it is included in the list given above chiefly because it is supposed to lie in the path of the ankle and plantar reflexes. But these reflexes were present, although only to a small degree and the probability or certainty is that the 5th lumbar segment is not the site of, nor in the path of, the lesion. Similarly the cramps in muscles partly supplied by nerves from this segment may be considered as due to lesions in association with lower parts of the cord, which also play a part in their innervation.

The portion of the cord associated with the nerve lesions is therefore decided as the 1st sacral to the coccygeal segments inclusive, with the possible exclusion of the first sacral.

Before endeavouring to determine the site and nature of the lesion it will be useful to bring together the chief facts of the history which supplement the nervous signs and symptoms. These facts are:—

(1). Severe blow to the sacrum.

(2). "Abscess" over sacrum, discharging pus and blood.

(3). X-ray evidence of spondylolisthesis at the lumbo-sacral articulation and of very horizontal position of the sacrum.
The conditions which must be considered in coming to a diagnosis include:

1. Neuritis.

2. Destructive lesion in the lowest part of the spinal cord.
   - Tumour
   - Haemorrhage
   - Gliosis etc.


4. Radiculitis.

5. Chronic meningitis localised to the sacral and lower lumbar portions of the spinal canal.

(1). Neuritis. This condition can be excluded at once by the absence of paresis in muscles supplied by mixed nerves which show definite evidence of damage to the sensory paths contained in them, and by the exact segmental and symmetrical distribution of the anaesthesia; and the absence of pain on gripping the calves is a point against the alcoholic form at least.

(2). Destructive lesion in the lowest part of the spinal cord etc. Anatomists restrict the name conus medullaris to the last sacral and coccygeal segments, but clinicians include the three last sacral and coccygeal segments. Even with this wider interpretation of the term it is not exactly applicable to our case because certainly the second and perhaps the first sacral segments are involved.

It must be said at the outset that a diagnosis between a lesion in the canda equina and in the lower part of the cord is not always possible, as is evidenced by mistakes made by such authorities as Erb & Bechterew.
Compression of the lowest part of the cord from without as by a tumour or a haemorrhage is unlikely because almost none of the many anterior and posterior roots which pass down beside the conus from segments above it are affected and yet the lesion has been bilateral from near the beginning of the illness and its effects are almost equal on the two sides.

In regard to a tumour in any part of the nerve paths as the cause of the symptoms it must be noted that the onset was more sudden and definite than is usual in cases of tumour, and what is much more important the symptoms have not shown the steady advance which is so characteristic of a tumour case, but have been characterized by a rather sudden onset, a remission, an exacerbation and a gradual improvement.

As to an internal lesion of the conus such as a haemorrhage or gliosis, the dissociation of sensation which often occurs in such cases is absent here, and the shooting pains experienced in both legs are not typical of a commencing intramedullary lesion.

In regard to any lesion of the conus it must be remembered that the conus is at the level of the first lumbar vertebra and that the commencement of the illness was preceded by a severe blow over the sacrum and that therefore a traumatic lesion of the nerve tissues is quite likely, but at the lower part of the cauda equina. In assessing the importance to be attached to the blow as a cause of the nervous symptoms it must be remembered that most men and especially working men can recall (quite vividly and truthfully) an injury of some degree or other in the back when requested to do so. Such a history might have been misleading in two cases, I have seen recently.
In one, a printer slowly developed paraplegia from the waist downwards "after" knocking his back against a piece of machinery, and an extramedullary neuroma was found at operation; in the other case a miner developed paraplegia after hurting his back, but a large focus of tuberculosis was found at operation. In the present case however the injury was of considerable severity and numbness and insensitiveness to touch and pressure were noticed in the region of the buttocks within 3 weeks of the accident (in which the sacrum and not the buttocks was struck), so that a traumatic lesion may be considered as quite possible, and if so the lesion would be expected in the sacral region.

(3) Pressure on the cauda equina. (Fig. 1)

A lesion affecting the cauda equina about the level of the sacral promontory would be more likely to produce the signs and symptoms of this case than one in or around the lower end of the spinal cord because apparently the roots, anterior and posterior, of the 1st or 2nd sacral to the coccygeal nerves inclusive are damaged and none of those higher up. The arguments used above against tumours in general being the cause of the disturbance equally apply here but a factor of possibly greater importance is the spondylolisthesis and tilting of the sacrum which might easily cause stretching of the roots of the 1st sacral to coccygeal nerves inclusive as they pass down the sacral portion of the spinal canal. Alto\'c, of course, we do not know the state of the spinal column before the accident it is quite possible that the severe blow in the region of the sacrum may have accentuated an already abnormal relationship of the lumbar and sacral portions, or it may have caused the whole of the deviation from the normal state which is seen at present.
But for two or three factors in the case this explanation would seem to be incontestably the most satisfactory which could be suggested. The disturbing factors are:—

(1). That the course of the symptoms can be divided into two clear stages, first the numbness and pains which commenced in February and gradually decreased until May, and second the sudden onset of bladder and rectum symptoms with extended anaesthesia and cramps which began in the middle of May and have slowly subsided since then until now.

(2). That an abscess discharging matter and blood was present over the sacrum when the second set of symptoms began in May.

(3). That the steady improvement in the case has taken place without any treatment aiming at improving or altering the position of the sacrum and that altho' the position of the sacrum may be abnormal at present there is no evidence that it was ever worse than or ever different from now; also, such a condition of the spinal column may be found in people who present no symptoms at all.

As an alternative to pressure of the bones of the spinal canal there is the possibility that a traumatic haemorrhage in the meninges may have accumulated and pressed on the lower part of the cana equina sufficiently to produce the initial set of symptoms, which are quite compatible with such a lesion. The interval of a fortnight between the accident and the first symptoms noticed by the patient might well be due to the slow accumulation of blood, and the improvement until May might well be due to absorption of the clot.

(4) & (5). Radiculitis. Chronic meningitis localised in the part of the spinal canal.
In looking for an explanation of the development of new symptoms in May it is quite possible that the abscess on the sacrum which the patient described "was associated with a mild infection of the lower spinal meninges which gradually subsided. The absence of febrile symptoms is not a point against a diagnosis of chronic meningitis, but is said to be a constant and important characteristic in chronic meningitis from any cause.

(5). Such an explanation of the two sets of symptoms seems to explain most of the phenomena found in the case and particularly to help us to understand the recovery made without special treatment of any kind.

Radiculitis may have one of several causes, of which syphilitic involvement is the commonest, producing the signs and symptoms of tabes dorsalis. In this case the Wassermann test of the blood is negative (which does not exclude syphilis from consideration) and the disease is at the same time confined and complete in its involvement. Both of these facts are against a diagnosis of tabes. An attempt was made to get an X-ray picture of the sacral foramina but this was not successful.

As to tuberculous disease of the meninges, no evidence of tuberculous involvement of the body canal (Pott's disease) was seen by X-rays, but there is still a primary meningeal form of the disease to be considered. This is rare, and in the absence of evidence of tuberculous disease elsewhere and the presence of trauma and abscess of the sacrum it seems the more unlikely alternative to choose in deciding between tuberculous and chronic pyogenic infection.

All these considerations lead me to diagnose haemorrhage into the meninges followed by a mild chronic infection of them,
although I cannot completely dismiss from mind the possibility of pressure on the cauda equina by the upper part of the sacrum. The former diagnosis, however, seems to me to take account more exactly of the course of the symptoms from the beginning until the patient’s discharge and of the relevant attendant circumstances of the illness.

REFERENCES.

(1). MULLER, L.R. "Untersuchungen über die Anatomie und Pathologie des Untersten Ruckenmarksabschnittes" Leipzig Druck von August Pries 1898.
Six Cases
Entered by
J. M. Alston.

Case V. Polyuria following Injury to the Head.

June 1934.
NAME - Charles McKenzie.

ADDRESS - City Hospital, Edinburgh.

AGE - 33.

SINGLE.

OCCUPATION - Chauffeur.

ADMITTED - 30/10/1933.

DATE OF EXAMINATION - 17/11/1933.

COMPLAINTS - (1). Dizziness in the head.

(2). Seeing double; with squint in right eye.

(3). Deafness in left ear with noises in left ear.

(4). Thirst.

DURATION - Since accident on September 1933.

HISTORY.

Personal.

Patient was on a motor cycle, alone, on the road from Forres to Grantown about 2-45 p.m. on September 4th (Tuesday) when he suddenly found that the bicycle was wobbling and he was very violently thrown off the bicycle for some distance. He was taken to Forres Hospital in an unconscious condition and regained consciousness only after 2 days.

On regaining consciousness he very soon found that he was deaf in the left ear, because he noticed that he couldn't hear a gramophone when lying on his right side. In a day or two he began to notice a hissing sound in his left ear.
This sound has been present ever since and is always the same kind of sound. Patient cannot stop the sound in any way, as by pressing his finger in the ear etc., this sound doesn't keep patient from sleeping and he says that it doesn't affect him in the least. When he is occupied he forgets about it altogether.

The sound changes somewhat in intensity at times, for example after patient returned to Edinburgh he was one day starting up a very noisy motor car and when he left the garage just afterwards he noticed that the noise in the ear was much louder than usual.

No improvement in hearing in the left ear has occurred since the accident and patient states that for conversation etc. he is quite deaf in the left ear.

For a day or two about a fortnight after the accident there was a small amount of rather fluid brown waxy discharge from the left ear. Patient noticed this because he is not accustomed to such a discharge from the ear, but he says that there was no blood in the discharge and it was a never clear water-like fluid.

The amount was never great. Patient states that the discharge never ran out, but was obtained on putting the finger into the external meatus.

It has now quite ceased. There was never such a discharge from the right ear.

The dizziness first occurred when patient was allowed out of bed at Forres. He was allowed out of bed to go to the lavatory about the third day after the accident and when on his legs found to his surprise that he had difficulty
in keeping his balance. He did not find that he staggered to one side more than to the other, but was more unsteady in the dark than in daylight. He had no unusual sensations in his head while he was unsteady: his head was quite clear.

This unsteadiness on the legs has decreased steadily since its commencement and patient states that now he can walk with perfect confidence, but couldn't run.

Patient states that there is no weakness of his legs, nor have they wasted, to his knowledge.

Patient has never fallen at any time.

After regaining consciousness at Forres patient's eyes were so swollen up that he could see out of neither. After 4 or 5 days he could see out of the left eye and in a few days longer he could use the right eye also and then he immediately found that he saw double especially when looking to the right. This double vision still remains, but is less than it was. At first patient would put out his hand to pick up the false image, but this doesn't occur now and his confusion is much less. At a distance of 2 or 3 feet from him he doesn't see double.

On visiting the Eye Department, Royal Infirmary, Edinburgh about 10th October the right eye was said not to move, but when he went back in a fortnight the eye movements were much better and have continued to improve.

The visual acuity of the left eye has never been affected, but the right eye has not quite such good sight as formerly, patient thinks.

Lately, since about 8 weeks after the accident, there has been a little yellow discharge in the left eye which
causes the left eyelids to be stuck in the morning on waking. Also, for two or three days at a time the left side of the bridge of the nose would be black, without pain or swelling. These conditions have now almost disappeared.

Patient first noticed the thirst about a fortnight after the accident just before he left Forres Hospital. It came on gradually. There was no increased hunger at the same time. Patient found that as he drank more he passed more urine. The urine has always been pale, and when the thirst was worst it seemed almost pure water.

The thirst and polyuria commenced gradually and were at their worst about 6 weeks after they started. Patient drank mostly water (and sometimes lemonade) to quench his thirst. When at its maximum patient found that he needed about a pint of water at a time to satisfy him and thinks he took about 8 pints during the daytime and 4 during the night.

Since their height about 6 weeks after the accident the thirst and polyuria have steadily decreased.

After patient regained consciousness in Forres Hospital he had sharp pains over the forehead and especially on the right side and also pain in the occipital region and the back of the neck. All these wore off after about a week.

Eleven teeth were knocked out in the accident.

On admission to Forres Hospital patient had a wound over the right eye stretching from above the inner half of the right eyebrow upwards and towards the median plane to within 4" of the roots of the hair. This wound was
stitched up and healed in less than a fortnight.

Patient remained at Forres Hospital for 15 days and was then allowed home on condition that he stayed in bed.

The first time that patient shaved after his accident (about 10 days after) he noticed a numbness and dullness of sensation on the right cheek from the level of the eye to the level of the mouth. This has gradually and constantly decreased but is still present to a small extent. Patient states that he has had no tingling or other sensations in this part of the face.

About a fortnight after the accident patient started to smoke and found that the smell was so unpleasant that he stopped smoking at once. This has now almost disappeared, altho' it persisted for some time, and now the smell of smoking tobacco is almost normal.

At first after the accident patient found that all his food was rather tasteless but this has distinctly improved.

The other day patient himself noticed that when he closed his left nostril he couldn't smell the tobacco he was smoking, and when he closed the right nostril the smell was slightly unpleasant.

Patient says that after he regained consciousness at Forres he had no loss of memory and no delirium.

After leaving Forres Hospital (15 days after the accident) patient went home for 5 weeks before he returned to Edinburgh. He spent the first of these 5 weeks in bed and during the other 4 weeks he got up about mid-day. On returning to Edinburgh patient didn't resume work, but visited the Eye and Ear Department, Royal Infirmary and saw Professor Bramwell on two occasions before he was admitted to the ward.
N.B. In the previous history, family history and examination the more important passages are indicated by a red line and the less important are inset.

PREVIOUS ILLNESSES.

German Measles - 2 years ago.
Accident causing scalp wound when 7 years old.
Surroundings at home and at work - good. Patient is a chauffeur.
Family History - Nothing to note.
Height 5'8½".
Weight 13 st. 11 lbs.
Development and muscularity - very good.

Scarf on right side of forehead and over left frontal bone. Remains of subconjunctival haemorrhage in right eye. Temperature 97°.

NERVOUS SYSTEM.

Intelligence - very good.
Emotional state - nothing to note.
Memory - good.
No hallucinations nor delusions.
Sleep - good when not disturbed by thirst or need to urinate.
No delirium, nor drowsiness, nor coma, nor fits, no vertigo.
Speech - nothing to note.
Patient is right-handed.
CRANIAL NERVES.

I. Left side. Smell appreciated in left nostril.
   Right side. No smell appreciated in right nostril.

II. Visual acuity. R. V. $\frac{6}{6}$ L. V. $\frac{6}{6}$.
   No errors of refraction.
   Fields of vision - no impairment can be detected.
   At the Eye Department the fundi were not examined.
   Pupil reacts by contraction to light by direct and
   consensual tests.
   Pupil reacts to accommodation on both sides.
   Pupils are round and equal.

III, IV, VI.
   Slight ptosis of right eyelid.
   No strabismus.
   Slight nystagmoid movements of right eye when looking to the
   left, but not to the extreme left.
   Ocular movements - all good except for slight paralysis of
   right external rectus.
   Diplopia. At present this is present only when patient
   looks to the right and is then due to paralysis of the right
   external rectus muscle.

V. Patient complains that he has a slight blunting of
   sensation on right side of his face between the level of
   eye and mouth. This cannot be detected with certainty by
   testing with cotton wool, but the patient is certain that
   there is a difference in the degree of light touch and also
   that there is a peculiarity of the quality of sensation
   (especially noticed when shaving) which patient says he
   cannot quite describe except by saying that the feeling
   slightly resembles a tingling.
Patient states that when he presses on a small area in the right temporal region he feels as though there were a slight contraction of muscle at the outer canthus of the right eye. There is no sign of contraction and the feeling is no doubt due to pressure on the zygomatico-facial branch of the trigeminal nerve.

Otherwise sensation in all other areas of distribution of V. is normal.

The masseter, pterygoid and temporal muscles are all strong.

VII. No impairment detected in the motor or sensory functions of this nerve.

VIII. Hearing markedly impaired on left side where tick of watch can be heard at no greater distance than 1 or 2 inches. Hearing in right ear normal.

Rinne's test. Left side, bone conduction good and much better than air conduction.

Right side: Air conduction better than bone conduction.

Weber's test. Sounds heard, but patient cannot tell in which ear they are more distinct.

Most unfortunately no record can be found in the Ear Throat & Nose Department of the examinations made there of his ears.

IX. - XII. Nothing to note.

CERVICAL SYMPATHETIC.

Pupils dilate to shade.

Cilio-spinal reflex couldn't be obtained.

Slight ptosis of right lid.

No exophthalmos; no enophthalmos.
No flushing nor abnormal sweating of head, neck, upper extremity.

MOTOR FUNCTIONS (Except muscles supplied by cranial nerves)

- No abnormal movements.
- No paralysis.
- No atrophy of muscles.
- Muscle tone good.
- No inco-ordination.

REFLEXES

- Abdominal - present on both sides.
- Plantar - flexor response on both sides.
- Knee jerk - present on both sides without re-inforcement
- Ankle clonus - not present.
- Knee clonus - not present.
- Organic - no disturbance.

SENSORY FUNCTIONS. (Except Cranial Nerves).

- Slight frontal headache (improving steadily) and a little pain on pressure over the mastoid process on the left side.
- Some vertigo - not noticed when patient is lying in bed except when the head is turned quickly to the left.
- Much more marked when walking, especially in the dark.
- This is improving every day.
- Objectively there is nothing to note.
- Vasomotor and trophic functions - nothing to note.

URINARY SYSTEM

- No subjective phenomena except frequent call to micturate.
No abnormal sensations during micturition.
No pain on pressure in kidney angles or over the bladder.
Urine - 40 - 80 oz. per diem while in hospital.
  Specific Gravity 1004 to 1010.
  Acid reaction.
  Pale straw colour.
  No deposit.
  Albumin - ve.
  Blood - ve.
  Pus - ve.
  Sugar - ve.
  Bile - ve.

REPRODUCTIVE SYSTEM.
Nothing to note.

LOCOMOTORY SYSTEM.
Patient is well developed in bone and muscle.
Joints - nothing to note.
Muscles - nothing to note.
X-Ray of head (lateral view) showed no signs of fracture nor abnormality of size or shape of pituitary fossa.

ALIMENTARY SYSTEM.
Subjective Phenomena.
Subjective Phenomena.

Appetite - not increased - nothing to note.

Thirst - As recorded in the history patient first noticed gradually increasing thirst about a fortnight after his accident. The thirst is not now so great as it was and altho' he drinks a good deal of water during the day patient is not wakened at night by thirst.

No other subjective phenomena.

Lips - nothing to note.

Teeth - Eleven teeth were knocked out in the accident.

Patient has an upper jaw denture.

Tongue; secretion of mouth; fauces; deglutition - nothing to note.

No vomiting.

Abdomen.

Inspection.

Well rounded but not too prominent

Umbilicus deeply placed. Muscular development good and a fair amount of fat present but not excessive.

No local prominences - rib margin not prominent.

Movements - free and equal on respiration.

Palpation.

Liver and spleen not palpable.

Nothing else to note.

Percussion.

Upper border of liver at 4th rib in right mammmary line and lower border 1" above costal margin in same line.

The lower curvature of the stomach descended to a
point 3" above the level of the umbilicus 1½" from the median plane.

Auscultatory - percussion confirmed the level of the lower border of the stomach.

HEMATOPOIETIC SYSTEM.

No subjective phenomena.

No enlarged lymphatic glands palpable.

Spleen and thyroid - nothing to note.

CIRCULATORY SYSTEM.

No subjective phenomena.

Pulse - Arterial wall, soft and vessel nor nortuous.

Regular in time and force.

Frequency varies considerably from 44 per minute to 72 per minute (extremes), but on the average is rather slow, about 64 per minute. Upstroke is good and normally well maintained, and the downstroke is normally rapid.

Arterial pressure - Systolic 115.

Diastolic 86.

HEART.

Inspection of precordial region - no apex beat or other pulsation visible. Nothing else to note.

Palpation - Apex beat not palpable owing to thick chest wall. No other pulsations.

Percussion - Left border of heart 1" to left of sternum at 3rd rib, apex in 5th left interspace.
Auscultation. Sounds pure and closed in all areas, faint in mitral area especially due to thick chest wall.

RESPIRATORY SYSTEM.

No subjective phenomena.
Breathing - abdomino-thoracic.
No sputum.
Palpation - Nothing to note.
Percussion - Lungs normal in extent and percussion note normal on both sides. Tidal percussion shows good expansion of apices and bases.
Vocal fremitus - normal.

Auscultation.
Breath sounds vesicular in type.
No accompaniments.
Vocal resonance - normal.

INTEGUMENTARY SYSTEM.

Scar on right side of forehead as recorded in history.
A scar of many years duration over left frontal bone, partially hidden by hair. Result of an accident.
SUMMARY OF SIGNS AND SYMPTOMS.

Accident on September 4th 1933.

Unconscious for two days.

Eyes. Both closed for 4 - 5 days.

Double vision as soon as both could be used.

Complete paralysis of right external rectus; now much improved.

Subconjunctival haemorrhage of right eye; now almost disappeared.

Vision $\frac{8}{6}$ in both eyes.

Ears: Left.

Almost complete deafness since accident.

Hissing sounds.

Discharge for a few days.

Rinne's test negative.

(Weber's test un conclusive).

Right.

Normal.

Unsteadiness on walking.

Noticed first when allowed out of bed and persisted a long time.

Present now only on running.

No vertigo.

Unsteadiness is to either direction impartially.

Thirst & Polyuria.

First noticed 2 weeks after accident.

Increased for about 4 weeks (12 pints drunk per diem).

Decreased since.

Urine has low specific gravity and no sugar.
Smell and Taste.

Loss of smell and taste complete at first, but now improved.

At examination no loss of taste and loss of smell in left nostril only.

Anaesthesia etc. on right cheek.

Numbness and dullness of sensation on right cheek from level of eye to level of mouth.

Improved.

Tender spot over right temporal fossa.

Pains in the Head.

Sharp pains over forehead and occiput for first week.

Wounds etc.

Right side of forehead.

Eleven teeth knocked out.
DIAGNOSIS AND COMMENTARY.

The interest of this case lies chiefly in speculations as to the nature and location of the lesions responsible for the various symptoms.

Of the actual observation of intracranial lesions we have no record, for X-ray examination revealed no fracture or other abnormality and it is very unfortunate that the records of the aural examination have been lost.

The groups of symptoms are varied, and taking that into account and also the fact that the injury which caused them all was a fall on the head it would seem unlikely from the beginning that any one lesion could be suggested as the cause of all the symptoms. This is borne out on closer examination, as will be seen. One notable fact is that, with the exception of the deafness on the left side, the patient's condition has steadily improved in every way.

The negative Rinne test indicates that the aural lesion on the left side is in the sound conducting apparatus, which is further suggested by the discharge which came from the ear for some time after the accident, and it is quite compatible with the tinnitus and the absence of improvement. The damage to the sound conduction might be in the form of a rupture of the tympanic membrane only, but since the deafness is often temporary after this lesion and chronic tinnitus not very common it is probable that there is damage to the contents of the middle ear cleft or haemorrhage into it, either alone or as well as rupture of the membrane.

In considering the paralysis of the external rectus muscle of the right eyeball the relations and connections of
the abducens nerve must be remembered. The nucleus of the VIth cranial nerve lies near the surface of the floor of the fourth ventricle under the colliculus facialis close to the median raphe and the commencement of the facial nerve-twists round it. The abducens nerve passes straight through the substance of the pons and emerges on the surface of the brain between the lower border of the pons and the upper border of the pyramid. In its extracerebral course it passes upwards and laterally to the angle between the apex of the petrous portion of the temporal bone and the root of the dorum sellae. At this point it pierces the dura mater and passes into the cavernous sinus where it lies on the lateral side of the internal carotid artery and medial to III, IV, & V. in the wall of the sinus. After leaving the cavernous sinus at its anterior end it passes through the superior orbital fissure in company with numerous nerves and arteries and supplies the lateral rectus of the eyeball. This anatomy is important in speculating on the site of a lesion which would affect the abducens nerve, its nucleus or connections and nothing else.

A lesion in the supranuclear path of VI. could never be so complete and yet not involve other tracts with the production of more extensive paralysis on the same side of the body if the lesion were above the pons and mid-brain or a crossed paralysis of III, V, and VI, if in the pons or mid-brain.

A nuclear lesion of VI can also be excluded by the absence in our case of any evidence of the involvement of VII, and an intrapontine lesion of the abducens nerve.
itself is ruled out for similar reasons. (1).

In its course outside the brain the nerve is in close relation to other nerves in the cavernous sinus, the superior orbital fissure and the orbit, but not between the hind brain and the dorsum sellae. A lesion in this part of its course is indicated therefore and especially at the root of the dorsum sellae where it pierces the dura and lies very close to the bone.

The recovery of power in the right external rectus indicates that the lesion had become repaired and pressure on the nerve by a small haemorrhage which became absorbed suggests itself or possibly slight involvement in a fracture of the adjacent bone. It is known that such involvement may cause only temporary failure of conduction and gradual recovery follow. Contusion of the nerve by being driven against the bone is another possibility.

In the case of the loss of taste and smell at examination there was found no loss of taste itself and loss of smell in the left nostril only. The same line of reasoning as in the case of the eye paralysis leads one to diagnose an extracerebral lesion rather than one in the area piriformis, hippocampus or related centres. The lesion may be due to haemorrhage around the olfactory striae bulbs or nerves, to damage to the bone of the anterior cranial fossa about the lamina cribrosa or contusion of the nervous structures by the bone. Again the temporary nature of the disturbance is to be noticed.

The anaesthesia of the right cheek is in the area supplied by the maxillary division of the trigeminal and
the lesion might be in the region of the foramen rotundum and might again be due to haemorrhage, damage to bone or contusion.

Lastly we come to the most interesting symptom — the temporary polyuria.

The excretion of large quantities of urine of low specific gravity without albuminuria or glycosuria may be a temporary or a chronic condition. The causes of the most temporary kinds are the ingestion of large quantities of fluids of low osmotic tension, hysteria, epilepsy, anxiety, sudden change in temperature. Peripheral stimulation is known to have caused polyuria for a short time, for instance an abscess in the auditory meatus produced marked polyuria, which subsided on evacuation to return when the free discharge of pus was obstructed and to disappear again as healing took place. (3).

Polyuria of low specific gravity and without glycosuria also occurs in chronic Bright's disease, amyloid disease of the kidneys, arterio-sclerosis, cerebral syphilis (gumma or meningitis in or around the fourth ventricle) cerebral tuberculosis tumour of the pons or medulla oblongata. Very important also are the cases associated with lesions, neoplastic or syphilitic especially (3), of the pituitary body. Degenerative changes in cells of the semilunar ganglion and the splanchnic nerve fibres are also recorded.

The name diabetes insipidus is given to an extreme and long lasting form of polyuria in which the pathology is not known, but vasomotor derangement and lesions in the hind brain are murmured softly. The amount of urine passed is
larger than in any form arising from any of the causes noted above and may exceed 600 ounces per diem, with an equal intake. The disease is very rare indeed and commoner in males. For long the health may not suffer and the patient remain vigorous and well nourished, but dehydration of the tissues may occur with hard skin, constipation, loss of muscular and other tissues, mental weakness and even coma and death. Many drugs have produced as many disappointments, and nothing more, in the way of therapeutic effects. (4).

In our case the mildness and temporary character of the affection, the absence of any evidence of syphilis, tuberculosis cerebral tumour, Bright's disease etc. and the close association with the accident to the head point to the causative lesion being either:

1. Peripheral irritation (as from damage to middle ear etc.),

2. Lesion (possibly small haemorrhage) in the floor of the fourth ventricle.

or 3. Lesion of the pituitary gland. This might be haemorrhagic or due to fracture of the base of the skull or contusion of the gland.

Considerations similar to those made before argue against a lesion in the hind brain and on the whole an irritation of the pituitary gland by concussion seems the most likely cause.

Reviewing the possible causes ascribed for the paralysis of VI, the loss of sense of smell, anaesthesia in region of maxillary division of V (right) and the polyuria, it will be noticed that haemorrhage, fracture or contusion in the
region of the base of the brain from the cribiform plate to the posterior margin of the sella turcica has been suggested in each case. Supposing that the same one of these three is the cause in each case contusion would seem to be the most likely in view of the evidence at our disposal. There is no history of a flow of blood or cerebro-spinal fluid from nose or ear as often or usually occurs in an extensive fracture or fractures of the base, although of course this negative evidence is very light. The idea of several haemorrhages at the base of the skull would lead us to expect more symptoms of prolonged intra-cranial pressure, whereas he was unconscious for two days and then rapidly regained his faculties, which would suggest concussion more than compression.

So much argument on such slender evidence and with the aid of so much hypothesis is very unscientific in many ways, but at least it serves to show vividly the necessity for interpreting clinical findings in the terms of anatomy, physiology, and pathology.

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REFERENCES.
WIGHTMAN PRIZE COMPETITION.

Six Cases
Entered by
J. M. Alston.

Case IV. Diabetes Mellitus.

June 1934.
NAME - GEORGE NEIL.
ADDRESS - 40 Dundas Street, Dundee.
AGE - 30.
OCCUPATION - Iron dresser.
PLACE OF BIRTH - Ayr.

Married.
Date of Admission - 16/10/23.
Date of Examination - 18/10/23.
Discharged - 30/11/23.

Complaint. - (1). Drinking a great deal of water.
(2). Passing urine every ¼ or ½ hour.
(3). Bowels were very costive.

Duration - Since about end of June 1923.

HISTORY.

Personal.
About end of June patient found he was often very thirsty. At night time he wanted a bigger tea than usual but at the other meal times he was not extra hungry. He had to get up two or three times during the night for a drink of water. The thirst became progressively worse, and he says he needed a drink every hour or half-hour. The increased hunger did not progress to anything like such an extent as the thirst.

When the thirst began, he also found that he was passing water more and more frequently - as often as he needed to take a drink. The urine he passed was greatly increased in amount and was colourless instead of the usual yellow colour.

At the same time patient found his bowels were becoming /
becoming /

cositive, whereas formerly they had moved regularly. He took pills, but they were not fully effective.

He stayed at work until July 19th but didn't feel so strong as usual at his work and felt very tired at night. He went to the Doctor on July 17th and the doctor sent him to Dundee Infirmary, where he was admitted on July 23rd.

He was in Dundee Infirmary for 10 weeks. He was in bed for the first 4 weeks, was allowed up from 11 o'clock until 4 o'clock for the next 3 weeks and then for the last 3 weeks he was up all day.

During the month or so previous to admission to Dundee Infirmary patient lost a good deal of weight and his chest bones became more prominent.

In Dundee Infirmary patient was given to begin with, four days of ordinary diet. Then he was cut down to starvation in seven days and then gradually the diet was built up until 7 weeks after admission patient had the following diet, approximately, while sugar free:-

**Breakfast.** Porridge (2 spoonfuls of meal)

1 egg and 2 slices of bacon.

3 oatcakes and tea.

pat of butter.

**Dinner.**

Chicken.

Cabbage.

Beef Tea.

**Tea.**

Tea.

2 Oatcakes.

thin slice of toast.

1 egg.
Supper. Beef Tea or chicken soup.

Occasionally 4 ozs. of malt per day were given.

Patient left Dundee Infirmary on September 24th and was sugar-free, and felt stronger than on admission. On returning home, his panel doctor said he wasn't fit for work. He increased a little in weight however.

His diet at home was:

**Breakfast.** Porridge.
Bacon and egg or fish.
Diabetic bread and butter.
Tea.

**Dinner.**
Soups (with only greens).
A little meat (lean with only a little fat).
Ground rice without sugar (sometimes).

**Tea.**
Boiled egg or fish.
Oatcakes.
Slice of toast.
Butter.
Tea.

**Supper.**
1 piece of diabetic bread.
Tea.

He felt pretty satisfied with this diet and was increasing in weight, but he couldn't work and the sugar in his urine (examined once a week by the doctor) progressively increased. His bowels acted quite regularly with only occasionally a Seidlitz powder.

He was not thirsty at this time and passed water only 3 or 3 times a day and not at night.
Patient states that about this time he had some pain and discomfort, not severe, in the loins, but this has almost all passed off now. Patient never noticed any change in the urine while the pains were occurring.

About this time moats began to appear in both eyes and have continued since. These are not large and do not interfere with reading etc., but they sail backward and forward in the field of vision. There has been no change in visual acuity.

Patient says that he has had some domestic worries since he has been married (5 years), but during the months immediately preceding the onset of the illness he worried less than formerly.

Patient says he has not had any headaches that he remembers since his illness began, except when in Dundee Infirmary when he was being dieted, and then he noticed that during starvation he had a pain for 3 or 3 days in the forehead just above the nose.

Patient states that he has always been very fond of sweets, cakes and tea-bread of which he regularly ate a good deal, especially on Saturdays and Sundays.

Patient says that neither during nor before his illness has he ever seen any change in his stools.

Patient says that the house he has lived in for last 4 years is not satisfactory. There are two rooms and the house is shared with married friends. The house is on the ground floor of a tenement, there is no water laid on and it has to be brought from a tap at the back of the house. There is dampness in the house and the beds are in recesses and are small and badly ventilated.
Before he was in Dundee Infirmary patient states that the end of the penis and the parts round about itched to some extent.
In the history of previous illnesses, family history and state on examination the more important passages are indicated by a red line and the less important passages are inset.

**PREVIOUS ILLNESSES.**

Measles in infancy.

Influenza 19-20.

While in the Army patient was kicked behind the left knee by a horse and didn’t get immediate medical attention. He went about for 2 or 3 days and then a painful swelling arose behind the knee. He was in Stobhill Hospital for 6 weeks and he required an operation. On discharge the knee was quite well and has given no trouble at all since. It is as freely moveable as the right knee.

Patient states that he has always taken his share of alcoholic drink, usually in the form of beer. He says he was never in the habit of getting drunk, however.

**FAMILY.**

Father - 49. Alive. He has some inward trouble about which patient is very indefinite, but it does not resemble patient's illness.

Mother - 46. Alive and well.

No brothers.

Sister 1. Alive and well.

An uncle died recently of cancer.

Wife is quite healthy.

**CHILDREN.**

2 boys, 4 1/2 and 3 1/2.
The elder dribbles his urine which the doctor says is due to laziness. There is nothing else wrong with the child.
The younger one is quite healthy.

STATE ON EXAMINATION.

Intelligence - Average.
Height - 5 ft. 5\frac{1}{2} in.
Development - Well developed man of rather a thin type.
Muscularity - Not very good for a working man. Muscles of the arms are especially small and lax, and patient says altho' he never had big muscles, they have become much smaller since his illness.

General Appearance. Patient has a thin, pale face. He has always been thin and pale he says, but his face is much thinner, especially about the temples since his illness.

Attitude. Patient looks rather serious and worried but is agreeable to speak to and answers readily.

Evidence of former illness etc. There is a scarred area occupying the lower part of the left popliteal fossa, evidence of the injury referred to in the history.

Temperature 96.6°F.
ALIMENTARY SYSTEM.

Patient is at present being dieted and therefore he is often hungry. His state as to hunger and thirst before entering Dundee Infirmary are described above.

He has no "sensations" to describe as occurring after meals; except for occasionally bringing up a little wind after meals he has never suffered from any form of indigestion. No acid taste in the mouth.

The lips are a little pale but show no abrasions.

Teeth.

There are 9 much decayed stumps in the upper jaw, but the other teeth seem sound though discoloured.

There are 3 much decayed stumps in the lower jaw and one molar is absent on the left side; the other teeth in that jaw are fairly healthy.

Patient says that he doesn't get any sweetish or sickly taste in his mouth from the teeth.

Gums.

The gums don't bleed, but there is some pus at the edge of the gum opposite one or two of the lower incisors.

The tongue is rather rough and a little furred.

The uvula is decidedly redder than the fauces round about.

The tonsils aren't enlarged, are pale and uniform in appearance.

The post wall of the oral pharynx is pale with small vessels seen running across it.

Bowels.

During dieting in hospital, patient needs medicine to keep his bowels active.
Abdomen.

Inspection.

Slightly rounded, but neither protuberant nor hollowed. Quite regular in form.

Respiratory movements are good and equal on the two sides. The pubic hair is confined to the pubis and an inch or so above (female type of distribution).

Palpation.

The abdominal wall is uniformly relaxed to a normal extent. The liver margin is not palpable below the costal margin. The spleen isn't palpable. No faecal or other masses were palpable in the colon. Slight gurgling occurred once on palpation at the pylorus, but there are no other symptoms and signs to indicate enlargement or fermentation in the stomach.

There was no tenderness at any point, not even in the kidney angles where patient states he had pain after coming out of Dundee Infirmary.

No fluctuation could be detected in the abdominal wall.

Percussion.

On percussion the upper border of the liver was found to be at the level of the 4th rib in the nipple line and the lower border at level of 7th rib in nipple line. The lower border does not reach the costal margin below the junction of 7th or 8th C. C. with the costal margin.

The lower border of the stomach was found to be an inch or so below the level of the umbilicus at a point about 1 inch to left of the median plane.
The stomach note reached to within ½ inch to left of the median plane.

No dullness was found in the flanks or in centre of the abdomen. The bladder had recently been emptied and no dullness could be percussed over the colon nor small intestines.

Auscultatory Percussion.

The level of the stomach as indicated above was confirmed by this method.

HAEMOPOIETIC SYSTEM.

There is no enlargement nor tenderness of lymph glands or thyroid.

Blood Sugar 0.308%

Wasserman - ve.

CIRCULATORY SYSTEM.

No subjective symptoms, referable to circulatory system, no pain in precordial pain; no palpitation, no faintness, no dyspnoea.

Pulse.

Arterial wall is perfectly soft and supple.

Rate is 104 per minute.

Regular in time and force.
Upstroke is normally rapid and of fairly good extent, and is normally well maintained. The downstroke is normal in rate.

Heart.

**Inspection of precordial region.**

The ribs and sternum are prominent all over the chest and the intercostal spaces are correspondingly deep. There is no distortion of the shape of the chest in the precordial region.

A faint pulsation is to be seen in the left 4th intercostal space inside the nipple line $3\frac{1}{2}$" from the median plane.

No extra cardiac pulsations.

**Palpation.**

Apex beat is faintly felt in 4th left intercostal space and at 5th C. C. $3\frac{1}{2}$" from the middle line.

**Percussion.**

The right border of the heart was just beyond the right sternal margin - 1" from median plane.
The left border was 2" from median plane at level of 3rd rib.

$3"$ from median plane at level of 4th rib.

$3\frac{1}{2}"$ from median plane at level of 5th rib.

**Auscultation.**

In all four areas both sounds were closed and there were no abnormal sounds.

In the aortic and pulmonary areas there was neither reduplication of the second sound nor increase in its
intensity.

In the mitral and tricuspid areas the first sound varied in intensity at different examinations and tended to be rather fainter than usual.

Veins.

No pulsation in the veins of the neck was observable, while patient was at rest, at any rate.

RESPIRATORY SYSTEM.

Subjective symptoms.

At the time of examination patient had a slight cough, but this was present for only 3 or 4 days and after that quite disappeared. During the few days that the cough lasted there was a small amount of thin mucopurulent sputum.

No other subjective symptoms.

Thorax.

Inspection.

The chest is rather of a long and narrow type, but is not flat and is quite symmetrical.

The ribs project forward from the intercostal spaces, especially in the region of the 3rd - 7th ribs.

The chest moves to a normal extent, and moves regularly (without jerking) and equally on the sides, on respiration.
Palpation.

Palpation verifies the extent and regularity of the respiratory movements.

Vocal fremitus is normal, and as usual is most marked in upper lobe of right lung.

Percussion.

The apices on both sides were found to reach to about 1" above the clavicle.

The percussion notes were equally resonant at corresponding points on the two sides and the borders of the lungs reached to the normal levels.

No areas of dullness were found in either lung.

Auscultation.

In both lungs the breath sounds were vesicular with the normal tendency to broncho-vesicular in the upper lobe of the right lung.

Crepitations were heard by listening over the right scapula just below the spine and near the vertebral border. These crepitations were only heard near the end of inspiration and in a limited area. They disappeared in a few days when the cough referred to above passed off.

Vocal resonance was normal.

INTEGUMENTARY SYSTEM.

Subjective phenomena - The itching of the skin of the penis, noted in history, is not now present.
Skin. The skin is very white on the whole. There is freckling of the back of the neck and back of forearms.

The subcutaneous tissue have a normal amount of fat.

No oedema.

There is a red, rather stippled appearance of the lower 1/2 of the nose, which patient says is always present. The condition might be a form of rosacea.

URINARY SYSTEM.

Subjective phenomena - none at present. Pain in loins, recorded in history, has disappeared. No tenderness in kidney angle on either side. Neither kidney is palpable.

Micturition - frequency, 6 times during the day, no times at night.

Urine - Amber coloured with a deposit of mucus.

40 ozs. in 24 hours.

Acid reaction.

Albumin - ve, Blood - ve, Pus - ve.

Sugar x ve (0.31% by Pavy's method).

Acetone - ve. Diacetic acid - ve.

Microscopic examination showed some crystals of calcium oxalate.
NERVOUS SYSTEM.

Intelligence - average.
Emotional state - an averagely stolid man of his class.
Memory - good.
No hallucinations nor delusions detected.
Sleep good.
No coma nor fits.
Patient is right-handed.

CRANIAL NERVES.

I. Sense of smell is good on both sides.
II. Visual acuity - left eye good.

right eye not so good. Patient received a blow from a snow-ball in this eye some years ago. Fields of vision in both eyes are unrestricted.

Ophthalmoscopic examination: -
Nothing to note in the optic discs and retina around them.
Moats in the sight noted in history.

III) No ptosis.
IV)
VI) No squint.
No diplopia.
Ocular movements good in both eyes and in all directions.

No nystagmus.

Pupils are equal in size. Patient says that for some time after the blow (noted above) received in the right eye the right pupil used to be larger than the left and he thought this was still the case, but they
are equal.

The pupils are perfectly round in both eyes.

The pupils react to light readily (direct and consensual), and to accommodation.

V. The masseters, pterygoids and temporals are strong.

The sense of taste was present on the anterior part of the tongue.

There is no loss of sensation on the face, conjunctiva or buccal mucous membrane.

VII. Movements of facial muscles are unaffected.

VIII. Hearing in both ears is good.

IX. Sense of taste is present on the post part of the tongue.

No dysphagia.

X. The palate moves well.

No laryngitic symptoms.

XI. Sterno-mastoid and trapezius are strong and not wasted.

XII. The movements of the tongue are unaffected.

CERVICAL SYMPATHETIC.

Pupils dilate to shade.

No proptosis.

No exophthalmos nor enophthalmos.

Patient has always sweated a good deal including the head and neck.

MOTOR FUNCTIONS.

No abnormal movements.

No paralysis.

The muscles have lost their tone and become shrunken to
a considerable extent since the illness began, and both arms and legs (but especially the thighs) show a looseness and thinness of the muscles.

All the muscles (systematically examined) were, however, quite strong and equally strong on the two sides.

Measurements of the thighs 5½ inches above the upper border of the patella,

left 14½ inches.
right 14 inches.

Co-ordination of movements was normal.

REFLEXES.

Superficial.

Conjunctival - present on both sides.

Palatal - present.

Pharyngeal - present.

Abdominal - present on left side. 
- absent on right side. 20/10/33.
- absent on both sides 22/10/23.

Plantar - strong flexion and bunching of toes on both sides.

Deep.

Elbow - faintly present on both sides.

Knee - absent on both sides with and without reinforcement.

Ankle - absent on both sides with and without reinforcement 20/10/23.

Present with reinforcement only 23/10/23.

Absent with and without reinforcement 24/10/23.
No ankle clonus.

Reflexes of micturition and defeecation normal.

**SENSORY FUNCTIONS.**

Patient complained for a week or so of a pain in the ankles when he walked about the ward. There was no stiffness in the joints and the pain soon became less and less. It was doubtless due to his weak condition and being so long in bed.

There was no tenderness on palpation.

No headache nor vertigo at time of examination.

No disturbances of sensibility to touch and pain were discovered.

Joint sense and sense of muscular contraction were found normal in arms and legs.

No asterognosis.

**LOCOMOTORY SYSTEM.**

Bones - nothing to note.

Joints - nothing to note except the slight pain in the ankles noticed on walking after being in bed for some time. The muscles in general are somewhat wasted and lax since the onset of the illness, and the thigh muscles show this most, but altho' small the muscles are all strong.
DIAGNOSIS.

The diagnosis of diabetes mellitus rests securely on the basic symptoms of polyuria and glycosuria, recurring in spite of restriction of carbohydrates in the diet, and the remaining symptoms of frequency of micturition, pruritus, constipation, loss of weight and strength and mucae volitantes all bear out the diagnosis.

In the differential diagnosis there must be considered:-

(1). Diabetes insipidus, which in any of its numerous forms is excluded by the high specific gravity of the urine and the presence of glucose in it. The case of Charles McKenzie in this series in which polyuria without sugar followed injury to the head is interesting in contrast to the present case.

(2). Chronic renal disease causing polyuria is excluded by the low blood pressure, by the absence of albuminuria and of thickened arteries and by the presence of glycosuria and high specific gravity of the urine.

(3). Renal glycosuria is excluded by the hyperglycaemia and by the fact that restriction of carbohydrates in the diet reduces the amount of sugar in the urine.

(4). Alimentary circulatory asphyxia and anaesthetic types of glycosuria are ruled out by the persistance and circumstances of the glycosuria.

(5). Hysterical glycosuria is discountenanced by the number of subsidiary symptoms present.
The patient was treated from October 16th to November 30th by Allen's diet (modified) and injections of insulin. During the first two days in hospital a full diet was given.

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<th>C. H. grams</th>
<th>Insulin</th>
<th>Sugar in urine</th>
<th>Acetone &amp; Diacetic ac.</th>
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7 at 11½

7 at 13
This case is a mild example of diabetes mellitus which did not show any of the more serious complications of the disease and which greatly improved under dietetic treatment and three doses of insulin.

Carbohydrate metabolism is a subject on which much light has been shed recently and an attempt will be made to outline the facts and speculations to which importance is attached at present.

The source of the carbohydrate material found in the tissues and fluids of the body is mainly the carbohydrates of the food and very slightly the proteins and perhaps the fats.

The carbohydrates which are ingested are hydrolysed by ferments in the mouth and gastro-intestinal tract and after conversion into mono-saccharides (chiefly glucose) are absorbed by the mucous membranes of the stomach and small intestine, and pass by means of the portal circulation to the liver. In that organ the mono-saccharides are converted by the liver cells into glycogen, in the process called glycogenesis. The blood leaving the liver has its carbohydrate content (in the form of glucose) kept fairly constant by the accession to it of the necessary amount of liver glycogen converted to glucose (glycogenolysis). The blood in turn replenishes the stores of carbohydrate material in the muscles and all other active tissues and these tissues store the carbohydrate in the form of a polysaccharide. How the polysaccharide is broken down to carbon dioxide and water and what relation these analytic changes have to the production of mechanical and chemical work is a problem very little elucidated.

While the liver (subject to a sufficient supply from the intestinal canal or from body tissues) maintains the blood sugar
content above a minimum the kidney on the other hand prevents the content rising above a certain proportion by excreting sugar in the urine when the blood sugar rises over about 0.3%.

The part played by the secretion of the islets of the pancreas is variously stated to be in the process of glycoenerolysis and in the process of glycolysis. In order to make the discussion of these "balanced" movements of substances more clear a short digression must be made to point out that it must always be remembered that the amounts of carbohydrate (or of any other substance) present in a medium such as the blood at different times should not be regarded as a percentage of the carbohydrate in all the other constituents bulked as a whole, but rather the ratio between all the constituents must be considered, and it is this ratio which tends to remain constant. In practice percentages are used because the absolute amount of only one or a few constituent substances is estimated and the assumption is made that the constituents not estimated are not altered in absolute amount. So long as this assumption is correct the discovery of an abnormal percentage of a constituent is equivalent to knowing the altered ratio of all the constituents.

Also when considering the amounts of material with which the tissues deal the time element must never be forgotten at any stage, since this factor causes variations in the amount of a substance present at a certain point at a certain instant and that is what alters the ratio between all the substances present at that spot at that time. Illustrations of the time factor are given in the varying rapidity of absorption from the bowel into the portal circulation.
This may be due in the case of a given amount of potential monosaccharides to their chemical state on ingestion, to the amount of other kinds of foods present in the digestive tract at the same time etc., and results in the liver having or not having at any time during the portal absorption an amount of carbohydrate material which is the maximum for the liver so long as its other constituents remain the same. Any carbohydrate ingested in excess of this maximum is passed to the systemic circulation.

Another example of the time factor is in the rate of the blood circulation. This will be referred to later in reference to certain types of glycosuria.

Many of the points in this problem of carbohydrate metabolism can be illustrated by a graph demonstrating (1) the rate of absorption from the bowel, (2), the storage in the tissues other than the liver, and (3), the sugar content of the blood after 100 gm. of glucose is rapidly ingested by a person who has previously had a normal diet.

\[ \text{Graph showing rate of absorption and sugar content} \]

A B. represents the rate of absorption from the bowel and it is clearly seen that the rate decreases as the difference in
concentration in the bowel and the portal circulation decreases. This factor of mass action is seen in all physiological processes in which the more elementary physical actions as osmosis etc. play a part.

The curve C B represents the percentage of glucose in the systemic blood while the recently absorbed glucose is passing from the liver to the other tissues. It will be noted that the blood sugar is represented as never rising to the concentration (0.2%) at which renal excretion of sugar as detected by the Fehling test commences, and at which, clinically speaking, glycosuria is said to exist.

By the curve C D is shown the rate of storage of the sugar in the body tissues.

After this sketch of the physiology a consideration will be made of some of the alterations in the body's action which may result in glycosuria.

(A). First of all there is the change in the action of the kidney which results in renal glycosuria. In this disease it would appear that the kidney eliminates sugar when the blood sugar content is below 0.2%. The result is that much sugar passes through the body unused (as occurs also in diabetes mellitus) but the muscles and other tissues are still able to use the sugar which reaches them by the blood and therefore the disease is of much less seriousness than diabetes mellitus. Renal glycosuria may exist for very many years without seriously deranging the patient's health.

(B). With every other factor normal, glycosuria may be caused by hastening of the circulation so that although the absolute amount of sugar in each unit of blood volume is unchanged yet more sugar is brought to the kidney in each
unit of time and thereby the ratio of sugar to the permanent constituents of the kidney cells is increased and sugar is excreted in the urine.

(C). Stimulation of the sympathetic system may cause glycosuria, in great part by hastening the circulation. The sympathetic stimulation may be brought about by airenalin or by cerebral irritation which may have some connection with the phenomenon of the sugar puncture and the factor of worry and strain in accentuating diabetes.

(D) (E) & (F). It is known that an alteration of the acid-base balance of the tissues and fluids may cause alterations in the excretion of sugar, and that an increase on the acid side favours glycosuria and a larger proportion of bases decreases the tendency to glycosuria. At what part of the carbohydrate metabolism, this change is supposed to have its effect I don't know. Possibly the transitory glycosuria found sometimes in association with asphyxia and the administration of anaesthetics is connected with a disturbance of the acid-base balance.

(G). In conditions of toxaemia glycosuria may be found.

(H). Alimentary glycosuria is a common and transitory condition which depends on the liver receiving from the intestine in a given time more sugar than can be stored by the liver or stored or used by the muscles.

(I). Finally there is pancreatic glycosuria or diabetes mellitus.

The manner in which the secretion of the pancreas affects carbohydrate metabolism is still under discussion. One theory or diagrammatic conception was that the islets of
Langerhans secreted a substance which constantly inhibited glycogenolysis in the liver while the secretions of the chromaffin bodies and the blood sugar content lowered by the combustion of the sugar in the tissues were always tending to increase glycogenolysis. In this way glycogenolysis was said to be finely adjusted and the islets of the pancreas and the chromaffin bodies were said to be in their turn stimulated and inhibited by other influences. A diagram is given of this theory which is now being discredited in many ways.

Other theories of the action of the pancreas credit it with an influence in the necessary changes in the carbohydrate after it has reached the muscle and before it can undergo the essential changes which are associated with the production of work and of CO$_2$ and H$_2$O. One big difference between the glycogenolysis and the glycolysis theories is that the former would have us to believe that the muscles and tissues are able to make use of
all the sugar available to them in the blood (which is a greater amount than normally), and the latter theory must drive us to the conclusion that the tissues must be hampered in the production of their various forms of work from the very outset of the disease. By the glycolysis theory the tissues must be supposed to be in the same position as they are in renal glycosuria in so far that there is a loss of sugar by the renal excretion while the tissues are still able to use what is brought them by the blood. But clinical facts show, that while renal glycosuria causes no marked loss of weight or power and is not liable to be followed by acidosis, in diabetes mellitus loss of weight and strength is usual (altho' not constant) and acidosis is always a danger notwithstanding the fact that in the more serious disease the blood contains more sugar than normally.

One theory which has arisen during investigations into the action of insulin is based on the fact that glucose exists in three isomeric forms and it is supposed that the pancreatic secretion or insulin is necessary in order to change the glucose from the earlier forms in which it may occur into the final isomer which alone can be utilised by the tissues.

In the broad outlines of the production of acidosis in diabetes mellitus there is comparative agreement. The general opinion is that fats are used to supply the energy necessary for the body in the absence of available carbohydrates and that since fats contain in their chemical constitution a much smaller proportion of & than carbohydrates do the oxygenating powers of the body may be ultimately overtaxed.
with the result that some of the split products of the fats, acetone, diacetic and oxybutyric acids etc. are left unoxidized in the body. Being predominantly acid in reaction they are neutralised by the alkalies and thus the alkalies of the body are reduced in amount and the reaction of the fluids is less alkaline than formerly. This reduction of the alkalinity of the body brings on the symptoms of air-hunger, headaches, weak pulse, coma which are summarised in the name acidosis, but the connection between the altered reaction of the blood and the symptoms following it are apparently not known.

Recently the majority of the members of the French Academy of Medicine after a discussion came to the conclusion that the acidosis of diabetes mellitus and of hydrocarbon starvation are essentially the same in the processes of their production.

It is of interest to note that an American has prepared for diabetics a synthetic fat from fatty acids having an odd number of carbon atoms. Such a fat will not lead to the production of any ketone bodies and thus it is hoped that the diabetic will be able to assimilate a certain amount of fat of this kind.

From the point of view of treatment there are two stages in diabetes, - acidosis and prior to acidosis.

According to the explanation given of the production of acidosis the main indications in the treatment of the condition are to provide carbohydrate in an assimilable form, to restore the alkaline reserve of the body to its normal state and to increase the tension of the circulation.
These indications are met (a) by the subcutaneous injection of 30 units or more of insulin, (b), subcutaneous or intravenous injection of 500 - 1000 c.c. of normal saline containing 50 grams of glucose and 2% sodium bicarbonate.

The necessity for exhibiting glucose is that without it the insulin might allow so much carbohydrate to be removed from the blood that a state of hypoglycaemia would result. The symptoms of this condition are anxiety, hunger, sweating, trembling, coma; and it would appear reasonable to suppose that it is an acidosis of carbohydrate starvation. It may be noted that the effects of hypoglycaemia may be guarded against by the administration of orange juice or of adrenalin.

The treatment in cases which do not present acidosis has two objects in view:—

1. To establish an alimentary equilibrium by means of dieting.
2. To increase the power of metabolising hydrocarbons by insulin.

The question of diet is placed first because it is still of prime importance, and insulin must be regarded at present as a very valuable (but expensive) adjunct to it.

In finding the diet required there are several points to be adjusted:—

1. The urine must be free from sugar and from ketone bodies.
2. The diet must be (with or without the help of insulin) sufficient to maintain the patient’s strength and power to perform his work.
3. The proteins and fats must be regulated in proportion to the carbohydrates, in such a way as to produce a "balanced" diet.
The ratio of the available glucose and fatty acids to one another and to the protein is most difficult to adjust while the patient's basal functions are not being maintained by the food he is given and he is using some of his body fat or protein.

The basis of calculation of the food given is the caloric value per gram and in every case the discovery of the correct diet and the correct amount of insulin is in the nature of an experiment which is checked by the state of the urine and the strength of the patient.

A reference has been made to the use of a special fat to avoid the production of ketone bodies, and it may also be noticed that some clinicians find that laevalose and other caramelised sugar are more easily metabolised in this disease.
WIGHTMAN PRIZE COMPETITION.

Six Cases
Entered by
J. M. Alston.

Case VI. Exophthalmic Goitre.
AGNES FRENCH, 36 years. Occupation - Housework.

ADDRESS - Creetown, Kirkcudbrightshire.

PLACE OF BIRTH - Craufordjohn, Lanarkshire.

Single.

Date of admission - 10th October 1923.

Recommended by Dr. Anderson, Dalbeattie.

Date of Examination - 13th October 1923.

Complaint.

1. "Swelling of the neck."
2. "Bad palpitation."
3. "No energy for work."
4. "Nerves have been bad."

Duration - All since about February 1923 when patient had a sore throat.

History: 1. Personal.

About the beginning of February 1923 patient got a chill in church on a Sunday, and that night she felt her throat sore. The throat continued to be sore all that week and patient went to her doctor (Dr. Smart, Creetown) on Friday or Saturday. During the week she had felt out of sorts, but did not take to bed, altho' she had considerable difficulty in swallowing and confined herself to fluid foods. The doctor gave some iodine for painting the throat and a bottle of medicine as a tonic. At first the iodine was too strong and after it had been used for a week was made weaker, and the weaker solution was used for another 4 days. After that treatment the throat was much better and the iodine was discontinued. Patient had never been much put off her sleep. Altho' not painful the throat seemed to be "thick" whenever patient swallowed.
The neck was swollen and painful on the left side immediately below the jaw while the throat was sore, but the swelling and pain disappeared when the throat recovered.

The soreness in the throat was only on the left side and it was on this side that the draught in the church blew.

In March the doctor could see nothing wrong with patient's throat altho' patient still felt it "thick." By this patient means that altho' there is no real pain in the throat at all, yet there is some feeling of difficulty of swallowing as if the throat were narrowed.

In April patient had a bad cold. After this cold patient noticed that her neck was swollen on the right side about 4 inches below the angle of the jaw. At the same time patient began to feel weak, and tired by her ordinary household exertions.

The "palpitation" began about this time. Patient was conscious of quick, severe beating in her chest and throat and it seemed to choke her. These attacks were worse at night and lasted sometimes for an hour or more. During the day if an attack occurred patient had to rest completely: at night they often kept her awake all night. She slept badly at this time.

Patient then found that she couldn't hold things well: she dropped them often because her hand shook. Her legs were also shaky when she tried to walk. Her general weakness also increased. Patient would have taken to bed, but she lives with her mother who is unable to do the housework.

The swelling of the neck gradually increased and passed across the middle line to the left side.

Soon patient noticed that she became more easily agitated as
when friends called to see her or when she found someone unexpectedly near her. She found her speech was becoming hesitating and when speaking to strangers her breath became laboured.

Also, she began to perspire more freely and found that fewer bed clothes were sufficient.

Patient's friends told her that her eyes were more staring than formerly; but patient couldn't see it in a mirror herself. Her sight was not affected.

She began to have occasional beating headaches but these weren't severe and she cannot say in what part of the head, if any, they were especially likely to occur.

Patient's appetite was good and she had no pains in the abdomen, nor constipation nor diarrhoea. About a month ago she was very sick. She felt sick before dinner but took her dinner and vomited about 3 hours afterwards. She recognised no food in the vomited material; at first the vomit was yellow, but then it got darker until it was dark green. The vomiting continued at intervals until 6 a.m. next morning. Patient had a headache during this time, but no visual disturbances. Several times she took baking soda and water during the period of these vomitings. There has been no recurrence of such an attack and patient had not had such an attack before the present illness.

She was conscious all the time of her heart beating, altho' she hadn't been conscious of this before. The heart was beating very quickly.

The swelling of the neck increased until July, but since then /
then /
the size of it (in patient's opinion) hasn't changed.

In June she went to Dr. Anderson of Dalbeattie, and he gave her a bottle of medicine. When she went back to him in a fortnight he advised her to go away for a change and stay in bed. She went to a farm near Thornhill for a month and stayed in bed. She felt much about the same at the end of this time and Dr. Anderson (whom she saw on her way home) changed her prescription. On returning home patient stayed in bed for 3 weeks and felt rather better and slept better. The shakiness of the hands decreased.

Patient lost weight considerably at the beginning of her illness, but she says that she always loses weight in the spring. This year, however, her friends assured her that she had lost much more than usual. She increased in weight somewhat in July or so, but decreased after the bilious attack and now she is sure that she is considerably thinner than ever before.

Patient states that she has been more easily worried by things since she became ill.

In May she found that her feet were both swollen: she doesn't remember whether the swelling was more marked at one time of the day than at another. The swelling didn't extend up the legs to any extent. This swelling went away after she began to take the medicine given to her by her doctor.

There was also swelling under the eyes, but this took longer to be reduced and patient says that it hasn't quite disappeared yet.

Patient states that she has a little difficulty in swallowing. There is no difficulty when the food is swallowed in small amounts; /
amounts; only when larger mouthfuls are swallowed. There is no pain; only a feeling of constriction.

She says that in August she gradually found her left leg becoming weaker than the right. She states that the left leg became slightly stiff especially at the hip-joint and tended to give way under her. There was a numb feeling in the left leg, but no pain of any kind. Patient remembers no twitchings in the leg. The commencement of this weakness was gradual and patient can give no date to it. The condition soon ceased to get worse and a definite improvement began, which has resulted in the weakness being only slight at the time of admission.

There was no similar condition in any of the other limbs nor in the face.
N.B. In the history of previous illnesses, family history and systematic examination the more significant passages are indicated by a red line in the margin and the less important parts are inset.

Previous Illnesses and Accidents.

Measles, scarlet fever in childhood. After scarlet fever (at age of 13) patient was "anaemic" for about 2 years. Mumps at age 20. Influenza occurred at the same time as mumps.

Patient has a cough or cold during nearly every Spring, but otherwise has been very healthy. She never remembers having a sore throat before February 1923.

No accidents to note. No operations.

Surroundings at home etc.

Patient has lived in the country all her life. The house patient lives in suits her very well.

Patient has always worked in the house, and has never been out to work.

2. Family History.

Father - Died at age of 83. Old age is given as cause of death.

Mother - Alive - 78. In weak health, but "no disease."

Brothers - 3. Alive and well. Another brother died in infancy.

Sisters - 3 Alive and well.

A niece of patient's suffers from the same illness (swelling in neck, nervousness etc.). In the case of the niece the illness began 14 years ago at the age of 17. The condition recovers for a time, but recurs, only during a cold. This niece has stayed with the patient during the holidays (once a year) /
but her home is near Manchester.

Patient knows one or two people in Creetown who have the same condition, but she says that it isn't a common condition there.
State on Examination.

Intelligence - Above the average of hospital patients.

Development - Good.

Muscularity - The muscles are rather thin and flabby. Patient says she never had big muscles but they are smaller now than previously.

General Appearance and Facial Expression - When patient is first approached she looks somewhat anxious and excited and there is obvious exophthalmos and flushing, but after some conversation she becomes normally calm and the exophthalmos almost entirely disappears. Patient is of a cheerful disposition and has a naturally high colour.

Obvious Morbid Appearance: Exophthalmos, as noted above.

Temperature - 99°F.

Height 5 ft. 5 ins.

Weight 7 st. 10½ lbs.
HAEMOPOIETIC SYSTEM.

When patient had a sore throat in February her neck was swollen and tender just below the jaw on the left side, but there is no swelling or tenderness in that region now and no enlarged lymph glands can be detected on palpation in the neck on either side.

The thyroid gland is considerably enlarged in both lateral lobes and at the isthmus. The enlargement is greater in the right lobe than in the left. The right lobe extends from the right sterno-clavicular joint to the level of the hyoid bone (4") and passes backward almost to the posterior border of the right sterno-mastoid muscle.

The left lobe extends from a point just above the left sterno-clavicular joint to a little above the level of the thyroid cartilage, a distance of 3". The left lobe doesn't reach as far back as the posterior border of the left sterno-mastoid and does not push the left sterno-mastoid muscle so much into prominence as the right lobe pushes the right muscle.

The isthmus, extending from ½" above the episternal notch to the lower border of the thyroid cartilage, is about 2" in length (from above downwards).

The thyroid gland pulsates on palpation, especially in the isthmus and the right lobe.

There is a loud blowing sound heard all over the gland on auscultation, and this is synchronous with the heart beats.

On palpation the gland is fairly firm, but not hard and is homogeneous in its firmness. Patient says that when the gland is pressed on both sides (not by hard pressure) there is a slight choking /
Sensation, which she doesn’t experience when no pressure is put on the gland, unless patient has been specially exerting herself.

The greatest diameter of the neck, opposite the isthmus of the thyroid gland, is 14\(\frac{1}{2}\) inches, 7 inches in the left hemi-diameter, and 7\(\frac{1}{2}\) inches in the right hemi-diameter.

The basal metabolism is reported to be +25%.

Blood - R. b. c. 3,870,000 per c. mm.

W. b. c. 6,800 " " "

Hb 70%.

C.I. 70 = .90.
NERVOUS SYSTEM.

Intelligence - Above the average of hospital patients.

Emotional state - Patient is much more easily disturbed emotionally than before her illness. It is noticeable that whereas she showed marked exophthalmos when first this examination began, it has become less and less as the examination went on, and now after a few days she shows very little exophthalmos most of the time.

Memory - Patient thinks that her memory for the passing events of her life, since her illness, has decreased.

Sleep. For a long time before admission patient didn't sleep well, partly because of the palpitation attacks complained of. Since admission, however, she has slept much better.

Speech. Patient finds that when excited (and she is more easily excited than formerly) her voice trembles and she thinks that it is always thicker than formerly.

Patient is right handed.

Patient has never had fits, to her knowledge.

Cranial Nerves.

I. Nothing to note.

II. Patient has had glasses for reading for 14 years, her distant sight is good. Sight has not been affected by the illness. Fields of vision are unrestricted.

Ophthalmoscopic examination:-

Optic discs and vessels and retina around discs appeared normal.

III. Movements of the eyeballs in all directions are quite normal and are equal and concurrent in the two eyes.

IV.

VI.
No ptosis; nor squint.

No diplopia.

During slow ocular movements, both laterally and up and down, there is a little jerkiness of the movement, but this isn't marked.

Von Graafe's sign, + ve on both sides.

On convergence the right eye ceases to converge and moves outwards when the object looked at is about 2½ - 3 inches from the eyes.

Pupils. Equal in size and both quite regular.

React to light (direct and consensual) and to accommodation.

V. 

VII. 

VIII. 

IX. Nothing to note.

X. 

XI. 

XII. 

Cervical Sympathetic.

Pupils dilate to shade.

Cilio spinal reflex - no change in pupil.

No proptosis.

Exophthalmos is present in varying amount. It is most marked when one begins to speak to patient but decreases as conversation and examination go on, and at its least is only just noticeable. When present it is equal on the two sides.

Patient flushes readily (more than before her illness) on surprise or emotion.

Patient /
Patient perspires all over the body more than normally, and especially the palms of the hands are constantly moist and hot. The skin generally is a little moist, but not so moist and clammy as often in cases of this disease.

**Motor Functions.**

Patient states that there is still some slight weakness and dragging of the left leg, but on examination of the strength of movements legs seem equal in power.

The muscles of the two legs are equal in dimensions.

There is nothing to note as to strength and condition of muscles of the other limbs and of the face, neck and trunk.

**Reflexes.**

Conjunctival - Present on both sides.

Pharyngeal - Only feebly present.

Plantar - Flexor on both sides.

Elbow - present on both sides.

Knee - present on both sides; not very strong, but equal on the two sides.

Ankle clonus - present and equal on both sides.

Organic reflexes - Nothing to note.

No subjective sensations, except numbness of left leg already referred to, and this is much less than it was.

Sensation - Nothing to note.

**Locomotory System.**

Nothing to note beyond what is recorded as to left leg; and the rather thin condition of the muscles of upper limb; also noted
INTEGUMENTARY SYSTEM.

About June patient was troubled with a certain amount of itching which was noticed all over the skin but this has passed away.

Since June or so patient has had a red spotted rash on the abdomen, in and about the middle line. Patient says the rash has been present since she began taking the medicine given to her by her doctor. There was no irritation with the rash.

Since July patient has noticed that she perspires more than formerly even when lying in bed, and now the skin is hot and clammy.

The skin generally is healthy looking and the subcutaneous tissues are not reduced in amount below normal.
CIRCULATORY SYSTEM.

Until this illness, patient had no subjective sensations referable to the circulatory system, but about the end of April patient began to experience attacks of beating sensations about the heart region with an accompanying sensation of choking and sometimes a shooting pain down the inner side of the left arm to the elbow or to the wrist. These occurred more frequently at night, but patient has had no such attack since she came into hospital.

Patient also finds that she becomes breathless after exertion which didn't occur before. Patient sometimes felt faint and became pale and had to sit down while working.

Pulse.

Arterial wall is not at all thickened.

Frequency - 130 per min.

Regular in time and force.

Up stroke rapid, but not of great extent, downstroke also rapid.

Blood pressure Systolic 138 mm.

Diastolic 78 mm.

Heart.

Inspection of precordial region.

There was nothing to note in the form of the precordial region. A pulsation was seen in a fairly wide area below the left nipple, and there was a slight pulsation in the 2nd intercostal space just to the left of the left border of the sternum.

Palpation.

A very strong impulse was felt in an area about 2" in diameter below the left nipple. A pulsation was also felt in the 2nd left intercostal space close to the sternum.
No thrill was felt. The apex beat was situated in the 5th left intercostal space, $4\frac{1}{2}''$ from mid line of the sternum.

Percussion.

The right border of the heart came just to the right border of the sternum.

The left border was $2''$ to the left of the left border of the sternum at the 2nd space; $3''$ to the left at the 3rd space and $4\frac{1}{2}''$ to left at the 5th space.

Auscultation.

In the four areas both sounds are closed, and there are no irregularities in the sounds. The rate of beat is 130 per min.

Electrocardiogram.

The electrocardiogram showed no abnormalities. The $P$, $Q$, and $R$ waves can be seen in all the tracings and the $S$ and $T$ waves in addition in one of them.
RESPIRATORY SYSTEM.

Patient has no cough or haemoptysis. She complains of being more breathless after exertion than she was before her illness (see above). The breathing is mostly thoracic, and is easy and unembarrassed.

Thorax.

Inspection.

The general form of the chest is a little flat, but there is no hollow at the sternum nor Harrison's sulci. There is a distinct hollow below the lateral end of the right clavicle. Above the clavicle, the right apex is not so full as the left and the trapezius on the right side is a little more square than on left side.

Palpsation.

Vocal fremitus is greater in upper lobe on the right side than on the left side. Movements are less at right apex than at left apex.

Percussion.

Right apex, above and below clavicle, is duller than left apex.

Auscultation.

Breath sounds, on the whole, are rather faint and gentle and vesicular in type, but in upper part of right lung these are more distinct and broncho-vesicular. Vocal resonance is distinctly greater in upper part of right upper lobe than at same point on the other side.
REPRODUCTIVE SYSTEM.

Patient states that since her illness commenced her periods have become more irregular. She has missed some, and some have been late.

They haven't lasted longer than formerly (5-6 days) and there has been no increased discomfort.
URINARY SYSTEM.

No subjective phenomena.

Urine:— Orange in colour.

Clear.

Deposit resembling mucus.

Albumin — ve

Blood — ve

Pus — ve

Sugar — ve.

Microscopic (after centrifuging):—

Uric acid crystals.

Epithelial cells (vaginal and vesical)

few in number.

A few leucocytes.

Amount — about 30-40 oz. per diem.

On examination, the kidneys were not palpable and there was no tenderness in the kidney angles.
ALIMENTARY SYSTEM.

Since illness appetite has remained unchanged, but patient has noticed that her thirst has at times increased, and she drank more water between meals.

No discomfort after food - no eructations, no waterbrash.

Lips - red, healthy.

Teeth - complete upper denture.

- in lower jaw, two molars have decayed to stumps on the left side, and 2 molars and 2 premolars are decayed on the right side. There is only occasional slight toothache and no sweet sickly taste such as might be due to pyorrhea, of which there is no evidence.

The m. m. of mouth, palate and oral pharynx are a little pale and the tonsils are not enlarged.

Abdomen.

Inspection - Skin, which is healthy and pink shows a red spotted rash in, and to each side of, the middle line. This rash has been present patient says since she began taking the medicine given by Dr. Anderson.

The abdomen is well rounded and symmetrical.

The umbilicus is deep.

There is a well marked pulsation (synchronous with the heart) in the middle line from xiphoid cartilage to the umbilicus.

The respiratory movements are not marked and the pulsation noted above made them less noticeable.
Palpation. There was no tenderness in any part.

There was no resistance at all in the flanks, but in the middle line over the pulsation noted above the patient didn't completely relax the recti muscles. To palpation the pulsation seemed to be immediately deep to the abdominal parietes.

No fluctuation.

The caecum appeared empty on palpation.

Percussion. Upper margin of liver in nipple line is 4th intercostal space and the lower border doesn't reach the costal margin by 1" in the nipple line.

The lower border of the stomach reached to about 2½" above the umbilicus at a point 1½" to left of median plane.

This level of the stomach was verified by auscultatory percussion.

The caecum and colon were resonant on percussion.

In the middle line over the pulsation and where the muscles were not relaxed, the note was duller than elsewhere.
DIAGNOSIS.

The diagnosis of exophthalmic goitre is based on the presence of the following symptoms and signs of that disease, namely:

(1). Enlargement of the thyroid gland.
(2). Tachycardia.
(3). Exophthalmos.
(4). Excessive sweating.
(5). Excessive warmth of the body.
(6). A fine tremor of the hands and fingers.
(7). Increased emotion.
(8). Increased rate of basal metabolism.
(9). Progressive loss of weight.
(10). Progressive loss of strength.

The differential diagnosis will be considered with the commentary.
Treatment and Condition since Admission.

Bed.

Light diet.

10/10/23 (date of admission).

Calomel gr. ii.


12/10/23 et seq. Tr. bellad. m. X. b.i.d.

During the night of October 13th - 14th (Saturday-Sunday) patient woke up suddenly and vomited some fluid matter which was colourless and tasted sour. She went to sleep after this. During the day on Saturday she hadn't such a good appetite as before and felt a little nauseated. Her appetite was not good on Sunday either.

About 9 p.m. on Monday October 15th. patient vomited without previous nausea about a hour after taking a cup of milk. The vomit consisted of the milk previously taken. Afterwards patient slept all night and felt well next morning and took her breakfast as usual.

15/10/23 et seq. Sod. brom. gr. X. b. i. d. at 9 a.m. and 9 p.m.

17/10/23. Patient, after 7 days in hospital, thinks that she is a good deal better than on admission. She perspires less, the tremor of her hands is less and her pulse rate is slower.

18/10/23. Patient hasn't been sick again, she feels stronger and less nervous and looks less anxious and excited.

23/10/23. General comfort and composure still improving. Patient was suddenly and quite unexpectedly sick after taking her dinner and brought up all the meal.

24/10/23. Patient didn't sleep very well during the night
to 24th but feels well in herself.

31/10/23. Less sweating; less nervous, sleeps well; no more sickness, pulse 108.

13/11/23. Symptoms continue to lessen.

Radium applied to right side of goitre for 24 hours.

13/11/23. Radium applied to left side of goitre for 24 hours.

17/11/23. Improvement noted as to all symptoms except that loss of weight still continues and patient is getting obviously thinner in the face.

Note of weight - 14/10/23. 7 st. 10\(\frac{1}{2}\) lbs.

18/10/23. 7 st. 6\(\frac{3}{4}\) lbs.

1/11/23. 6 st. 13\(\frac{1}{4}\) lbs.

17/11/23. 6 st. 9\(\frac{3}{4}\) lbs.

19/11/23. Evening temperature 99.6°F.

20/11/23. Morning temperature 97.3°F; evening 97°. Patient felt her throat sore on right side. Difficulty in swallowing. General redness of fauces and pharynx especially on right side.

21/11/23. Throat painted with tincture of iodine twice daily until 27th November. Exophthalmos more marked again.


The pulse rate was little affected by the sore throat and continued its former rate of 88-110 per min., only twice rising to 120 per min.

Patient says that her general symptoms continue to improve Von Graafe's sign can still be observed. Sweating and warmth of the skin are much less and tremor of the fingers altho' present is less marked than formerly.

The size of the thyroid gland has decreased so that the greatest /
greatest /

circumference
diameter of the neck is 13\(\frac{3}{4}\) inches (\(\frac{3}{4}\) inch less than at the
commencement of treatment) and the isthmus has taken the
largest part in this improvement.

This was the patient's condition when she left hospital.
COMMENTARY.

By way of commentary on this case an attempt will be made to indicate the respective parts possibly played by the thyroid and the medulla of the suprarenal in producing the symptoms of exophthalmic goitre, and to consider the claim for a psychogenetic origin of the disease.

The following is a resume of the line of thought adopted.

1. Action of thyroid secretion on the secretion of adrenalin.
2. Symptoms of adrenalin injection found in exophthalmic goitre.
4. Remaining symptoms of exophthalmic goitre.
5. Symptoms of thyroid extract absent in exophthalmic goitre.
6. Symptoms of exophthalmic goitre not produced by the exhibition of thyroid extract.
7. Where does the thyroid secretion act, and how?
8. Psychical symptoms of the disease and previous emotional disturbances.
9. Analogy with the state of fear.
11. Treatment with some sidelights it may throw on etiology and processes of the disease.

1. "Direct proof of the hypersecretion of the thyroid in exophthalmic goitre is thought to be furnished by the experiments of Reid Hunt who found that the blood of a person afflicted with exophthalmic goitre increases the resistance of mice to /
"the poisonous effects of acetoneitrile; an effect he had
previously found to result from injection of thyroid extract." (E. S. Schafer "Endocrine Organs" 1st ed. pp 38-39).
Experiments have also proved incontestably that thyroid feeding
increases the size of the suprarenals and increases the amount
of adrenalin they contain, but in exophthalmic goitre only one
observer (A. Fraenkel) has determined a marked increase of
adrenalin in the blood, while at least three others have
obtained negative results. (Schafer 2nd ed. Vol. I.).
This does not prove that an abnormal amount of adrenalin is not
passing through the circulation and being used by the system, as
occurs in carbohydrate metabolism for instance, without the
concentration in the blood being increased.

Herring found that administration of adrenalin excites
the thyroid to activity, probably through its sympathetic nerve
supply, and a current of action is known to be obtainable from
the thyroid when the cervical sympathetic is stimulated; and
in dogs fed for some time with extract of whole suprarenal the
iodine content of the thyroid shows considerable increase
although adrenalin alone produces no effect in this direction.

Another interesting determination is that feeding with
thyroid increases the sensitiveness of animals to the vascular
effects of adrenalin, and a test for hyperthyroidism is
recommended which has this fact for its basis.

Although all these results appear to bring prima facie
evidence for the close interaction of the thyroid and suprarenal
excretions whenever one or other is increased, and although, as
will /
will be shown in some detail later, many of the symptoms of exophthalmic goitre are those observed after adrenalin administration, yet Schafer states (2nd ed. Vol. I. page 56) that the symptoms of exophthalmic goitre cannot be ascribed to free adrenalin, but must be due to an increased excitability of the sympathetic, the cause of which is at present undetermined. In this connection, I have not been able to find any observation of enlargement of the suprarenals in the pathological reports of the disease which I have read.

While remembering Schafer's authoritative statement on the subject it will be permissible to consider which symptoms resemble and which differ from those of adrenalin administration. As is well known adrenalin acts almost solely by stimulation of the myoneural junctions of the sympathetic (thoracic autonomo) nerves, and the following table shows (a) the symptoms of exophthalmic goitre which resemble the action of adrenalin, (b) the symptoms of adrenalin administration absent in exophthalmic goitre and (c) the symptoms of exophthalmic goitre directly opposite to those of adrenalin administration.

<table>
<thead>
<tr>
<th>E.g. symptoms resembling adrenalin.</th>
<th>Adrenalin symptoms absent from e.g.</th>
<th>E. G. symptoms opposite to adrenalin.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachycardia.</td>
<td>Inhibition following tachycardia.</td>
<td></td>
</tr>
<tr>
<td>Fibrillation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exophthalmos.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycosuria (in 2%).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albuminuria.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyuria (in 13%).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall of Blood Pressure.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dilatation of pupil (rare) | Dilatation of pupil (constant) | Dilatation of skin vessels. (almost constant) | Constriction of skin vessels (very rare) | Constriction of skin vessels (constant) | Sweating. | Vomiting & diarrhoea.

A list may now be given of the symptoms commonly found in exophthalmic goitre in addition to those tabulated in "a":

- Increased Metabolism.
- Loss of weight.
- Warmth.
- Increased appetite.
- Sweating.
- Dilatation of skin vessels.
- Tremor of hands and fingers, nystagmoid movements of the eyes etc.
- Emotion.
- Vomiting and diarrhoea.
- Functional paralysis, mania, melancholia, other mental symptoms.
- Menstrual derangements.

Of these symptoms, increased metabolism with loss of weight mostly closely resemble the effects of thyroid extract administration and increased appetite and body heat, dilatation of skin vessels and sweating may be reasonably considered as secondary to the increased metabolism.

Vomiting and diarrhoea may follow the administration of thyroid extract which is found experimentally to cause contraction of the plain muscle of the stomach intestine (as opposed to adrenalin which relaxes it).

Cushny says, however, that unbiased examination indicates that /
that
thyroidism and Graves' disease are quite distinct conditions, which have few features in common and which offer many contrasts. Gley & Claret hold that the symptoms of exophthalmic goitre are produced as the result of a perverted thyroid secretion.

One of the commonest symptoms of the disease which has not been authoritatively observed to follow thyroid administration is exophthalmos, which however is not essential to a diagnosis of exophthalmic goitre and which may occur, by the way, in only one eye.

It may be noticed that although the site of action of adrenalin is known to be at the myoneural junctions of the thoracic autonomic nerves, the site of the chemical action by which the thyroid secretion stimulates metabolism is not known, but evidence of its function is obtained in myxoedema in which large amounts of some substance accumulate in the tissues because the secretion is not present in sufficient amount to decompose it.

In regard to metabolism and especially carbohydrate metabolism Dreschfeld has found that the vomiting and diarrhoea of exophthalmic goitre are associated with acetonaemia and acetonuria; also, whereas in cretins the number of red blood corpuscles is said to be often decreased, in exophthalmic goitre they are often increased but by no means always so. (3) They were found to be decreased in our case.

A consideration of the psychogenetic theory of the disease will now be given.

All physicians recognise emotional instability and disturbance as a frequent factor in the etiology.

Osler says "A strong family predisposition may exist and
or six members may be affected. Fright is a rare cause. Various depressive influences, such as worry, nervous strain, disappointment in love, illnesses and mental shocks, as well as "dread of the disease itself, may have an important influence" (4).

Many symptoms are common to exophthalmic goitre and a state of fear, as tachycardia, exophthalmos, tremor of the hands etc. Increased excitability, sweating, and dilatation of skin vessels, although in fear blanching may occur first, and dilatation of the pupil which sometimes occurs in exophthalmic goitre.

Reverting for a moment to the question of the suprarenal, Cannon found in the cat, that the dilatation of the pupils and upstanding of fur which accompany sudden alarm or excitement, are associated with an increased outpouring of adrenalin into the suprarenal veins.

It is noticeable in patients suffering from exophthalmic goitre that not only are they very responsive to external stimuli but that they are readily put into a state of dread or fear by, say, preparations for therapeutic procedures, and often this state of dread accompanied by irritability and restlessness precedes the grosser physical signs of the disease. On the other hand the remark of a well-known physician is recorded that he had noticed that nearly all the occupants of a tramcar during an air-raid suffered from exophthalmic goitre (5).

As well as the resemblance between the symptoms of the disease and a state of fear it is to be noted that complications may arise of a kind which are universally recognised to be psychogenetic. Such are functional paralyses, obsessions, phobias /
phobias / melancholia, mania. In our patient there was fairly definite evidence of functional paralysis.

These considerations may or may not pave the way for the acceptance of a classification of the disease as a neurosis, for modern psychology is like Socialism and rice-pudding - you either lap it up greedily and express robustious contempt for those whose tastes differ or else you find it revolting and stomach-turning and you will have none of it.

Stoddart states that the disease is a particular variety of the anxiety neurosis, and asserts that it is absolutely certain that any reputable physician, confronted with a patient presenting symptoms of the anxiety neurosis plus either exophthalmos or an enlarged thyroid, would diagnose exophthalmic goitre.

In 1890 Byrom Bramwell wrote that it is not uncommon to find cases of Graves' disease with an absence of exophthalmos or enlarged thyroid or both. These imperfect cases are commoner, he says, in men.

It may be granted that the symptoms of the anxiety neurosis are very similar to those of exophthalmic goitre with the exceptions that exophthalmos and enlarged thyroid are not usually described in the former and that the mental symptoms are less prominent usually in the latter.

According to the Freudians the anxiety neurosis is due to sexual excitations which are unable or not allowed to follow their natural course of leading to either physical gratification or even conscious desire for this. The mechanism of the neurosis is that when desire is repressed it becomes replaced in the consciousness /
consciuess / by its opposite — viz., fear; not necessarily fear of the particular object which is unconsciously desired, but an ill-defined apprehension especially of objects reminiscent of the original object of desire. The reason why the repression of sexual desire is especially potent is merely that sexual desire is infinitely more liable to be repressed than any other.

In the case of exophthalmic goitre Stoddart says that "the usual sequence of events seems to be (1) a fright, worry or anxiety induced by some incident or circumstances which "symbolize sexual aggression; (2), partial or complete "repression of the incident or circumstances, whereby the fear "is left unattached and therefore liable to attach itself to "any transitory situation; (3), partial or complete repression "of the fear which then finds expression in the symptoms of "exophthalmic goitre, which are nothing more than the physical "accompaniments or, as I think, bases of fear."

As a further argument for this theory Stoddart states that the disease is curable by psycho-analysis and that no other method of therapy cures the mental symptoms. The latter part of this claim however may be questioned in view of the recovery from some of the mental symptoms which is often noted in other methods of cure, as the disappearance of the functional paresis in the case of our patient.

It would seem only fair to say that until the general physician has convinced himself by study and experience that exploration of the mind throws no light on the disease he cannot fairly /
fairly / adjudicate on the psychogenetic claim. Whether or not psycho-analysis can cure the condition is a separate question and time and results must be waited on.

One theory of the disease is that it is due to an infection of the thyroid, often secondary to infection of the throat. The occurrence of the disease soon after influenza is noted, and out patient is an example of commencement following a throat infection. It must be admitted that the thyroid rarely shows signs of acute inflammation in exophthalmic goitre. The psychiatrists would no doubt regard recent or concurrent infections elsewhere in the body as merely a coincidence.

Treatment of the disease follows about four main lines. Firstly, there is the destruction of thyroid tissue, by operation, X rays or radium, or by the injection of alcohol (6). Much success has followed these methods, especially operation, and they seem to meet the indications of all theories of the disease except the psychogenetic.

The administration was tried of the serum of sheep or the milk of goats from which the thyreoid had been removed. Success was claimed for the method, but it has not survived. (7).

Of drug treatment apart from that of single symptoms, the exhibition of belladonna, phosphate of soda and opium have been tried, but since opium is stated by Schafer to increase the thyreoid secretion the unwillingness of the symptoms of exophthalmic goitre to be banished by it can be sympathized with.

Finally psycho-analysis is claimed as a cure for the disease /
and has the theoretical advantage at least that it fully meets the indications which its devotees state to be present in the case.

[For list of References see next page]
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