SYMPTOMATOLOGY OF CONGESTIVE AND SIMPLE GLAUCOMA

A STUDY IN CONTRAST

BY

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The cardinal feature of glaucoma is a raised intraocular pressure, as was first fully established by the Scottish physician, William MacKenzie, in 1830. He ascribed the raised tension to an increase in the watery contents of the globe due to a serous choroiditis. Sometimes increased tension is associated with, and secondary to, a concomitant pathological process, but the cause of the increased pressure in primary glaucoma is neither obvious nor well understood. Raised intraocular pressure in itself is, of course, not recognized by the patient, but it is associated with a variety of symptoms.

In the adult there are two main types of primary glaucoma—congestive and simple—and they differ clinically in their mode of onset. The former is characterized by symptoms of haloes and blurred vision or by an acute congestive attack; the latter by an insidious onset which usually escapes notice until the disease is well established. Congestive glaucoma is so often accompanied by a shallow anterior chamber with a narrow chamber angle that the disease is frequently designated, in American literature, as "primary narrow chamber angle glaucoma" (Friedenwald, 1949).

Simple glaucoma is associated with any breadth of chamber angle. Analysis of the series of cases examined gonioscopically at the Institute of Ophthalmology (Hobbs, 1950) in the main supports this generalization, as shown in Table I.

TABLE I.—Angle of the Anterior Chamber in Glaucoma

	Narrow	Medium	Broad	Unclassified
Congestive ..	61	12	2	6
Simple ..	20	43	32	4

Angles which were completely obstructed by peripheral anterior synechiae were unclassified.

Early Signs: Congestive Glaucoma

The most dramatic form of onset is the acute attack of congestive glaucoma which usually starts in the hours of darkness and is characterized by severe pain in the eye irradiating throughout the distribution of the trigeminal nerve. There is profuse lacrimation, the eyelids and conjunctiva may be swollen, the eye itself red, angry, and hard, with a dull insensitive oedematous cornea and a dilated pupil. Vision may be reduced to perception of light, and severe prostration is often accompanied by nausea and vomiting. Such an onset may occur without warning and with great suddenness in an eye which is apparently healthy. On the other hand, the attack may be preceded by prodromal symptoms. In a small series of 20 cases of acute glaucoma for which a broad iridectomy had been performed in one eye, eight cases had prodromal attacks and 12 had no warning symptoms.

Warning symptoms, when they occur, are therefore of some importance, because their recognition may avoid the onset of an acute congestive attack. They consist of haloes or rainbows round lights, short-lived attacks of pain in the

eye, and temporary blurring of vision. Such symptoms are always evanescent and periodic, and their significance may not be realized by the patient or sometimes by the physician.

A glaucomatous halo is best seen on looking at a point focus of bright light in a dark room. Two coloured rings are usually seen, an inner blue-violet and an outer yellow-red. They are produced by the diffraction by tiny droplets of fluid in an oedematous cornea of the rays of light emitted from the point source, their physical causation being analogous to that of the naturally occurring rainbow. There are other causes of haloes, chief among which is senile sclerosis of the lens. Glaucomatous haloes are always temporary, however, whereas lenticular haloes can be demonstrated at any time of day under suitable conditions; furthermore, when glaucomatous haloes are viewed through a slit they suffer a diminution in intensity, whereas lenticular haloes appear to be broken up into sectors.

Haloes occurring early in the course of the disease may be said to be pathognomonic of congestive glaucoma. Of the 81 cases of congestive glaucoma detailed in this paper 73 were aware of haloes, although not necessarily as a first symptom, and eight had an acute attack without prodromal symptoms. Haloes also occur late in the course of simple glaucoma, and of the 99 cases of simple glaucoma examined 11 advanced cases gave a history of coloured rings round lights. That they are not entirely a function of a narrow chamber angle is shown in Table II.

TABLE II.—Incidence of Haloes in Both Congestive and Simple Glaucoma and the Nature of the Chamber Angle

Angle	Haloes	Absence of Haloes
Narrow ..	59	22
Medium ..	13	42
Broad ..	5	29
Unclassified ..	7	3

It is often maintained that haloes are easily overlooked by a poor witness or that other subjective visual disturbances may be misinterpreted as haloes. On the other hand, if the patient is reasonably intelligent and the examiner careful to elicit a detailed description, including the presence of colour, there is little possibility of confusion. In this series of cases examined at the Institute there are examples of patients with lenticular haloes who have been using daily miotics unnecessarily, and there are others who have lost the sight of one eye, a tragedy which could have been avoided had the patient realized the significance of haloes seen round lights a few years earlier. As Duke-Elder (1940) has written, haloes are regarded by some patients "with interested amusement and by others with lively terror." Prognosis is much better in the latter group.

Simple Glaucoma

Simple glaucoma has a different type of onset of a very insidious nature. The presenting symptoms are not specific and may have a varied pathology. Sometimes there are no ocular symptoms at all in the early stage of the disease, and it is first suspected on routine ophthalmological examination. An early symptom is difficulty in close work. Patients ascribe their troubles to a haze on their spectacle lens unrelieved by frequent cleaning. They find it difficult to describe their symptoms in detail; the print is out of focus, grey in colour when viewed through the affected eye, and uncertain in outline. Patients who present these symptoms may be short- or long-sighted, and their difficulty is due to a reduction in their power of accommodation.

It has been observed in the glaucoma clinic that a patient who reads 6/5 and J2 with his glasses when the intraocular pressure is within normal limits may require an addition of +0.5 D sphere to his distance glasses and an addition of as much as +2.5 D sphere to his reading glasses to attain the same visual acuity when his intraocular tension is raised. The commonest presenting symptom is a permanent blur

FIG. 1.—Case 305 (glaucoma simplex). Chart of intraocular tension. — Right eye (glaucoma simplex). ---- Left eye (normal).

in the vision of one eye. This is not a sign which occurs early in the course of the disease, for examination of such a patient will show a well-marked defect in the visual field which must have developed over a considerable period of time. The loss of field, however, is insidious, and at first monocular, so that it remains unnoticed until such time as the normal eye is occluded—usually by accident. There are two other later signs—constant eye-ache and a noticeable gap in the field of vision. These are, however, late symptoms which force themselves into the consciousness of the patient only after considerable ocular damage has been done.

The earliest symptoms noted in simple glaucoma cannot be explained entirely in terms of intraocular tension. Difficulty in reading is probably due to the effect of a raised intraocular pressure on the ciliary muscle, so that the range of accommodation is decreased and the near-point recedes beyond the usual comfortable distance of 10 to 12 in. (25

to 30 cm.). Eye-ache can also be equated with intraocular tension, as in the patient whose 24-hour tension curve is shown in Fig. 1. The tension of the right eye lies wholly above 45 mm. Hg Schiötz. Patients who complain of a gap in the field of vision have in fact a large scotoma which has broken out to the periphery so that a whole quadrant of the field is blank (Fig. 2), or they may show a relatively small scotoma which approaches close to the fixation point (Fig. 3). The latter patient was an amateur bee-keeper, and he noticed as a first symptom that bees walking across his right hand tended to disappear. Those who complain of a permanent blur in one eye have, as a rule, a combination of a definite field defect and an intraocular tension which is above normal limits during most or all of the 24 hours.

FIG. 3.—Case 207 (glaucoma simplex). Right field of vision charted May 4, 1951, by Mr. H. E. Hobbs. Blind spot mapped by 10-mm. white object at 2,000 mm. — 5-mm. white object. ---- 2-mm. white object. R.V.=6/6.

Table III analyses the first symptom noted by the patient in 180 cases of glaucoma examined at the Institute of Ophthalmology, London.

TABLE III.—Initial Symptomatology—First Symptom

	Congestive Cases	Simple Cases
Acute attack	13	0
Attacks of pain in the eyes	8	0
Temporary blurring of vision	11	0
Halo	49	0
Constant eye-ache	0	13
Difficulty in reading	0	20
Gap in the visual field	0	13
Permanent blur in one eye	0	44
No symptoms	0	9
Total	81	99

Variations in Intraocular Tension

Congestive Glaucoma

The reason for the evanescent nature of the symptoms of congestive glaucoma is found in the behaviour of the intraocular pressure in an untreated case. Fig. 4 shows that the tension is highest just before going to bed, when the symptoms of haloes, blurring, and pain are at their height, and lowest in the morning after sleep.

That sleep has a beneficial effect on the symptoms of congestive glaucoma is well recognized by patients. Their eyes are usually easier in the morning, and even a doze in the middle of the day will relieve them of blurring or ocular

FIG. 2.—Case 16 (glaucoma simplex). Left field of vision charted March 27, 1949. 3-mm. object at 330 mm. distance. L.V. = 6/6.

FIG. 4.—Case 291 (congestive glaucoma). Chart of intraocular tension.

pain. Fig. 5 shows the effect of sleep in an untreated case. Emotional strain and fatigue have a contrary effect and precipitate rises in tension.

An important aspect of these observations lies in the recognition of the episodic nature of the increased intraocular tension in congestive glaucoma. Early in the disease haloes may be noticed only occasionally—perhaps once a fortnight—so that whole days or weeks may pass without a rise in intraocular tension. As the disease progresses, haloes become more frequent, but a patient who gives a history of nocturnal haloes may have a normal tension when examined at a morning clinic. The only clue to the diagnosis is often a history of haloes, and confirmation of their glaucomatous nature in terms of Schiøtz tonometric readings requires an examination of the patient *when the symptoms are in evidence*.

FIG. 5.—Case 281 (congestive glaucoma). Chart of intraocular tension.

Simple Glaucoma

The variations in the intraocular pressure of simple glaucoma which have been investigated and described by Langley and Swanlung (1951) differ from those of congestive glaucoma in one very important aspect. The diurnal variation tends to be constant in extent and time, so that any 24-hour period is diagnostically as suitable for examination as another. It is true that early in the disease the intraocular tension is within normal limits at most times in

the day, so that a single Schiøtz reading is of very little value. The diagnostic importance of a 24-hour tension curve in doubtful cases has probably been underestimated, and this is best undertaken in both types of glaucoma *before miotics are prescribed*. The variation in the intraocular tension in a normal eye during 24 hours is in the region of 3 to 5 mm. Hg Schiøtz, with an upper limit of 25 to 27 mm. (Fig. 6). Most glaucoma curves are abnormal in two respects—the range of the variation and the maximum height of the curve.

FIG. 6.—Case 185 (no evidence of glaucoma). Chart of intraocular tension.

The difference in the two groups is emphasized in Table IV, which shows that a high percentage of patients with simple glaucoma are unaware of a close association between their symptoms and the time of day; whereas most congestive cases find that their symptoms are consistently aggravated at night.

TABLE IV

		Symptoms Worse		No Difference	Total
		Morning	Evening		
Congestive	..	5	62	14	81
Simple	..	8	19	72	99

Cupping of the Optic Disk

In Table III there was a small group of cases of simple glaucoma diagnosed on routine examination. These patients had no ocular complaints even in retrospect and, until the diagnosis was made, believed their eyes to be perfectly healthy. The clinical sign which raised the suspicion of glaucoma in the examiner's mind was cupping of the optic disk on one or both sides.

There are various forms of cupping of the optic disk, which can be differentiated from the glaucomatous type only with difficulty. A physiological cup may be deep, but it rarely involves the whole area of the disk, so that one side shows a gentle slope to the point of emergence of the central vessels. The excavated portion may be white and the mottled lamina cribrosa clearly discerned in its depths, but the remainder of the disk is usually pink.

A well-established glaucomatous cup involves the entire circumference of the disk with steep sides. It is white, sometimes with a peripapillary halo of the same colour where the sclera shines through an atrophied retina and choroid. All grades of cupping exist between the physiological and the pathological, and indeed the former may pass imperceptibly into the latter, so that at some stages of glaucoma their differentiation may be quite impossible. Of the 29 cases of doubtful glaucoma referred to the Insti-

tute for investigation, 27 had cupped disks. Follow-up investigation of this series of cases over some years will prove of great interest, for it is possible that some, at least, are in the preclinical stage of glaucoma simplex and will eventually disclose their true nature in response to one of the many periodic tests performed upon them.

Cupping of the optic disk is not an early sign of congestive glaucoma. Table V shows that 54 of 60 early cases of congestive glaucoma presented no pathological cupping, whereas all 88 early cases of simple glaucoma had some form of cupping, 83 of which were frankly pathological.

TABLE V.—*Cupping of the Disk in Relation to Type of Glaucoma*

	Pathological Cupping	Physiological Cupping	No Cupping
Congestive {early ..	6	9	45
late ..	19		2
Simple {early ..	83	5	
late ..	10	1	

There is a close association between cupping and field loss as shown in Table VI. Field changes may coexist, however, with a normal disk, or a normal field may be found in association with a clinically pathological cup. Both are probably the product of one process acting at a different locus and apparently independently.

TABLE VI.—*Cupping of Disk in Relation to Visual Fields*

	Fields		
	Full	Scotoma	Depressed
Pathological cupping ..	5	103	10
Physiological cupping ..	8	4	3
No cupping ..	34	4	9

Field Changes

Changes in the visual field are not an early feature of congestive glaucoma. The majority, as shown in Table VII, have no demonstrable field defect when the diagnosis is made, either centrally or peripherally. The late cases of congestive glaucoma have visual field changes in every way comparable to those found in glaucoma simplex, provided there has been no acute congestive attack.

TABLE VII.—*Scotomata in Congestive Glaucoma*

	Baring of the Blind Spot	Scotoma	Full
Congestive {early ..	15	2	43
late ..	8	13	

Of the 13 cases which had suffered an acute congestive attack, five responded to medical treatment. Four of these five had full fields and excellent vision, and in the other the field was markedly depressed, although vision was 6/6. Of the eight cases which had been treated surgically, two had cataracts, two had full fields, three had slightly depressed fields with good vision, and one had very depressed fields and poor visual acuity. Scotomata seem to be uncommon as a sequel to an acute congestive attack.

Perimetric findings are most valuable in the diagnosis of early glaucoma simplex. Their configuration was fully described by Traquair in 1935, and nothing new has been added since that time. The earliest sign is found by examining the patient with a large Bjerrum screen at 2 metres distance with a small white object 1 mm. or 2 mm. in diameter. Normally this isopter forms a circle subtending an angle of 30 degrees from the fixation point, so that the blind spot lies within its confines. In glaucoma simplex this isopter is altered in such a way as to lay bare the blind

FIG. 7.—Case 136 (glaucoma simplex). Left field of vision taken at 2,000 mm. distance on February 21, 1950. — 5-mm. white object. - - - 2-mm. white object. L.V. = 6/6

spot, which now lies outside the deformed circle. Small isolated scotomata then appear (Blaxter, 1950) which coalesce with the blind spot to form arcuate scotomata which spread above or below the fixation point (Figs. 7 and 8). Such signs are inconstant, and in untrained hands are difficult to elicit. All the cases of glaucoma simplex in this series had defective fields, the changes varying from baring of the blind spot to absolute amaurosis.

The Threat to Vision.—It follows as a corollary to the analysis of visual-field changes in the two groups of glaucoma that the threat to vision is much greater in the simple than in the congestive type. Congestive glaucoma being a disease of symptoms, ample warning is usually given of disturbed function. If adequate therapeutic steps are taken the danger to sight is not great, whereas simple glaucoma develops slowly and quietly with few symptoms and no apparent disturbance in function. In this series,

FIG. 8.—Case 310 (glaucoma simplex). Right field of vision taken at 2,000 mm. distance on June 5, 1951, by Mr. P. L. Blaxter. — 5-mm. white object. - - - 2-mm. white object. R.V. = 6/9.

cases with a visual acuity of less than 6/60 in one eye amount to 37% of simple and 11% of congestive cases. Only three of the congestive cases had an acute attack. The cause of loss of vision in the others was due to neglect of warning symptoms.

Incidence

Table VIII shows that the average age of diagnosis of simple glaucoma is later than that of congestive glaucoma and that the congestive type is more common in women. A positive family history was obtained in 10% of both types of glaucoma in the series examined. This figure cannot be accurate, for many patients have little knowledge of their close relatives.

TABLE VIII.—General Incidence

	Congestive	Simple
Average age of diagnosis ..	54.2 years	59 years
Sex	51 F.; 30 M.	47 F.; 52 M.
Family history	8/81	10/99

The relationship of glaucoma to refraction is drawn up in Table IX. The distribution curves in percentages (Fig. 9) are remarkably similar, showing two peaks at +1 D and at -1 D. Although the curve for simple glaucoma lies on the myopic side of that for congestive glaucoma, the disease is much less common in myopia than in hypermetropia.

FIG. 9.—Glaucoma and refractive error. — Congestive glaucoma. ---- Simple glaucoma.

TABLE IX.—Glaucoma and Refractive Errors

	Hypermetropic	Myopic	Emmetropic
Congestive:			
Up to 1 D ..	22	9	5
" " 2 D ..	21	1	
" " 3 D ..	10	1	
" " >3 D ..	10	2	
Simple:			
Up to 1 D ..	26	17	12
" " 2 D ..	15	4	
" " 3 D ..	9	5	
" " >3 D ..	7	4	

Each patient was interviewed by a lady almoner, and a social history was obtained which included questions on occupation, home conditions, working conditions, financial state, and personality reaction. Table X indicates that many of them are anxious and nervous individuals, more especially among the congestive cases. On the whole, glaucoma patients are industrious and conscientious citizens who set high standards for themselves and who are easily disturbed if these standards are not met.

Typically, a patient with congestive glaucoma is an anxious and conscientious woman in the early fifties who

TABLE X.—Psychological Background in Glaucoma

	Congestive	Simple
Anxious	48	41
Overconscientious	11	7
Depressed	2	1
Aggressive	3	3
No obvious pattern	17	47

complains of haloes and attacks of blurred vision, especially in the evenings, and on examination is found to be a hypermetrope with good visual acuity, full fields, and normal fundi, and whose eyes present shallow anterior chambers with narrow angles.

A patient with simple glaucoma may be a male or a female in the late fifties who has noticed a vague but constant difficulty in close work for some months and thought a change of glasses was necessary. Examination reveals a low hypermetrope or myope with poor visual acuity in one eye, scotomatous fields of vision, and cupped disk or disks; anterior chambers are of moderate depth and the angle is of medium breadth.

Sample analyses of the 75,000 or so persons registered as blind in Great Britain reveal glaucoma as the cause in 15% (Sorsby, 1951). Earlier diagnosis is one way by which this figure can be reduced. Research on the fundamental disturbance in glaucoma also depends upon the examination of early untreated cases before dysfunction gives way to organic change. The family medical practitioner is most likely to see the patient early in the course of the disease. He should suspect its presence in all patients over the age of 40 who request advice on their eyes, especially if they have ever seen haloes or if one eye is more affected than the other. If he were to refer such patients to colleagues competent to diagnose ocular disease, it is possible that cases of congestive and simple glaucoma would be diagnosed earlier and treated more effectively.

Summary

Analysis of 180 case histories of patients with glaucoma supports the following conclusions:

(1) Congestive narrow-angle glaucoma has an acute onset or begins with periodic attacks of haloes, ocular pain, or blurring. Simple glaucoma has an insidious onset with unspecific ocular symptoms—reading difficulty, eye-ache, blur in one eye—or the disease may be diagnosed before symptoms arise.

(2) Elevation of intraocular tension in congestive glaucoma is episodic, precipitated by emotional strain and fatigue, and relieved by sleep. The diurnal variation in intraocular pressure in simple glaucoma tends to be constant for any 24-hour period.

(3) Cupping of the optic disk is not characteristic of early congestive glaucoma, but is nearly always found in simple glaucoma, and its extent is closely related to the degree of field loss.

(4) Changes in the visual fields are not found in early cases of congestive glaucoma either centrally or peripherally. Central field changes are, however, an early and valuable sign of the simple type.

(5) The threat to vision is less in congestive than in simple glaucoma.

(6) Congestive glaucoma is diagnosed at an earlier age than is simple glaucoma and is commoner in the female sex. A genetic basis is found in 10% of cases of both types.

(7) The distribution of the two types of glaucoma over the refraction range is very similar.

(8) Patients with congestive glaucoma are usually nervous and worrying individuals. This tendency is less marked in simple glaucoma.

(9) A plea is made that practitioners should suspect the disease in all patients over 40 years with eye symptoms, especially if haloes have been seen or if there is a unilateral disturbance of vision.

This analysis touches very briefly upon the work of Mr. G. D. Elphick on visual fields, Mr. H. E. Hobbs on gonioscopy, and Mr. D. A. Langley on the phasic variations in simple glaucoma, carried out at the Glaucoma Clinic under the direction of Sir Stewart Duke-Elder. The social histories were taken by Misses Abbey, Armstrong, and Collis; patients were mainly referred from the surgeons of Moorfields, Westminster, and Central Eye Hospital; the secretarial work was undertaken by Miss J. Brown: to all of whom my thanks are due.

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CEPHALIC TETANUS WITH REPORT OF A CASE

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Cephalic tetanus is a rare disease developing after injuries to the scalp, face, or neck, and associated with palsies of cranial nerves III, IV, VI, VII, IX-X, XII, singly or in any combination. Although general tetanus does not always follow, the condition is invariably associated with some degree of trismus.

Cumstone (1918) and Raven (1940) both recognize a type of cephalic tetanus after head or face injury which is without palsy and in which trismus is the principal sign. This type should not strictly be included in the term "cephalic tetanus," since it does not differ from local tetanus as found in other parts of the body. For this reason it is suggested that the term "cephalic tetanus" should be limited to those cases in which there is a cranial-nerve palsy. For this reason, again, cases such as those of Hyman (1935), in which there was tetanus with trismus and slight neck stiffness after tonsillectomy, and Bagchi (1929), who reported generalized tetanus associated with discharging ears, are not true cases of cephalic tetanus, in spite of the injury being limited to the head.

Rose (1869) is generally credited with the first comprehensive description of the disease, although Sir Charles Bell reported a case in London in 1836 and Pollock another from Dublin in 1847. Brown (1912) reviewed 94 cases, and in 1935 Abel and Hampil comprehensively reviewed the earliest literature on tetanus in general. Jayme-Goyaz (1941) and Wetzel (1942) almost simultaneously published reviews on cephalic tetanus in relation to eye injuries. For the past 25 years the *Quarterly Cumulative Index Medicus* has reported on an average two to three cases annually, bringing the present reported total to over 200.

Case Report

A 19-year-old engineer's apprentice was admitted to the Radcliffe Infirmary on July 17, 1949, as an emergency. His complaint was stiffness of the jaws for the previous 12 hours. There was nothing relevant in his past or family history, and he had always enjoyed good health. On July 7 he had had an accident while riding a bicycle along a flint road which was strewn with hay. He fell off and received a cut over his left eyebrow from a pedal. At no time was he unconscious. With a friend he telephoned for a car, which brought them to his doctor in five minutes. After cleansing, two stitches were put into the wound and he received a prophylactic injection of antitetanic serum into his left deltoid. He was home, in bed, within half an hour of the accident. On the next day he felt quite well except for a slight headache behind the left eye which lasted for two days. His doctor, however, advised him to remain in bed.

On July 16 he was allowed up by his doctor for the first time. He felt a little tired but had no other symptoms. Later in the day he had slight difficulty in closing the left eye, but took little notice of this. During the night he was awakened twice by an involuntary closure of the jaws which caused him to bite his tongue. On waking the following morning he noticed that he could not move the left side of his face as well as his right if he spoke or smiled. The left side felt "stiff." Next he noticed that the jaw was "stiff" on the left side. These symptoms progressed. At 8 p.m. he was seen by his doctor, who found a complete left facial palsy, trismus, and no other signs. He sent him into hospital. There had been no difficulty in swallowing and no stiffness anywhere apart from the trismus.

On admission he looked healthy and felt perfectly well apart from the palsy and slight trismus. In fact, he treated the whole matter as a joke. His temperature was 97.8° F. (36.6° C.), pulse 60, and respirations 20.

Examination showed a moderately deep wound over the left eyebrow, 1½ in. (3.8 cm.) long, sprinkled with penicillin powder. It was clean and there were no signs of inflammation. Multiple superficial abrasions were present on both elbows, extensor aspects of both forearms, both palms, and the left knee. These were healing well. There was no stiffness of the neck, back, or abdomen. He had a well-marked upper and lower facial palsy on the left, but could with an effort give a short whistle now and then. He could not close the left eye, although the right closed normally. The left naso-labial fold was almost completely obliterated. There was also mild trismus. No further abnormalities of the cranial nerves were found; the fundi appeared normal, and tone, power, movement, and reflexes in the limbs and abdomen showed no abnormality. The plantar responses were flexor. There was no abdominal rigidity. The cardiovascular and respiratory systems were normal. The blood pressure was 110/80. Urine analysis revealed no abnormal constituents.

Progress and Investigations

He was at once put to bed and given 100,000 units of antitetanic serum intravenously and 100,000 units intramuscularly. He received phenobarbitone and sodium amylal and was given a high-calorie high-protein diet. A skull x-ray film showed no fracture or other lesion.

July 18.—The stitches were removed and a swab was taken from the wound, which appeared quite clean. *Clostridium tetani* was not cultured from the swab. The haemoglobin was 17.4 g.%. The white blood cells numbered 5,000, with a normal differential count. The blood sedimentation rate was 1 mm. in one hour (Westergren). The Wassermann and Kahn reactions were negative. He was well and was fairly active in spite of the sedation. The accompanying photograph was taken on this day.

July 19.—The trismus was increasing and he was having difficulty in taking solid foods.