

and united in the middle line by means of silk-worm gut sutures. One or two sutures are usually required in front of the penis, that is in the pubic part of the wound, and the sheath of the penis itself is fixed to the edges of the skin, which embrace it by a few sutures. This method of closing the wound is apparently identical with that described by Major Charles.

*Skin grafting the penis.*—The final stage of the operation consists in the grafting of skin on the penis.

Strips of skin of the necessary length are cut from the outer side and front of the left thigh, the skin of which has previously been prepared for the purpose. The left thigh is selected in preference to the right, as it is much easier to cut grafts from the outside of the former, than that of the latter. The graft should be cut as thin as possible, so thin that little or no bleeding results from the operation. The number of grafts required depends upon their width; from two to four will usually suffice. These grafts having been carefully adjusted in position, the whole penis is covered with a piece of lint spread with boric acid ointment. The frayed edges of the lint are fixed to the skin of the pubes by means of collodion, and the whole secured by a piece of broad tape. Captain Niblock uses guttapercha tissue in preference to boric acid ointment, which he considers liable to injure the vitality of the grafts. It is not evident from Major Charles' paper why he postpones the skin grafting to a later period. By grafting the penis at the first operation, not only is further operative procedure unnecessary, but the healing of the parts is much expedited; the healing of the penis being completed almost as soon as that of the remainder of the wound. If the skin grafting be postponed until the fifth day, the healing of the wound will be retarded to a corresponding degree. Moreover, the operation has much greater chance of success if the grafts are applied to a fresh raw surface than to surfaces covered with a layer of lymph five days old.

*The dressings.*—Until comparatively recently I have been in the habit of fixing the dressings by means of the T bandage, but that method is decidedly inferior to the figure of 8 bandage, as used by Major Charles and also by Captain Niblock.

*After-progress and results.*—The first change of dressings is made twenty-four or thirty-six hours after operation, for the purpose of removing the drainage tube.

No further change is required until the sixth or seventh day. Provided no complication arises, the patient is generally fit to be discharged by the twenty-first day; some on the eighteenth and nineteenth days.

The after-result of these cases is, I believe, excellent. Unfortunately very few native patients return to show themselves, but in those

that I have seen the result has been very good. Although the position of the testicles plastered against the perineum is at first somewhat embarrassing, yet in the course of time this rights itself, and a regular scrotum becomes developed. Recurrence is impossible provided the operation has been conducted on correct principles.

*Mortality.*—There is no operation in surgery, of similar magnitude, in which the ratio of mortality is so low as it is in this case. Even when tumours of great size, one hundred pounds and more, are removed, the shock is comparatively slight, provided there has not been much loss of blood. The successful results obtained by Major Charles in his series of 143 cases show that when care and skill are exercised the risk of the operation is very small.

Captain Niblock in the Madras Hospital has also had excellent results; namely, 51 cases without any deaths. In my own cases, 125 in number, two deaths have occurred. One of these serves to illustrate the necessity of exercising extreme caution in conducting the examination of the urine in these cases. In this instance the urine had been examined on several occasions, and was said to be healthy, and this report was verified by my assistant. Operation was followed by symptoms of extreme and unaccountable depression, and death occurred on the second or third day. Before death the urine was found to contain a large quantity of sugar. In the second case the patient, who was an elderly and feeble man, succumbed to the effects of sloughing of the wound.

The statistics of the mortality after this operation are of extreme interest, as showing the progress of surgery within the last forty years. The first published statistics were those of the General Hospital, Calcutta, from 1859 to 1871, recorded by Sir Joseph Fayrer. This report included 193 operations with a mortality of 18.2 per cent.; twenty-one cases dying from septic disease. A later report of the same hospital given by McLeod includes 129 operations with a mortality of 17.7 per cent. The records of the General Hospital, Madras, from 1870 to 1884 show 115 operations with a mortality of 14.78 per cent. In 1886 the mortality in Madras had fallen to 7.37 per cent. During the last five years the mortality has been still further reduced, the figures being as follows:—170 cases with 4 deaths, giving a mortality of 2.3 per cent. It is improbable that the mortality will ever be reduced to a lower ratio than this.

#### THE FLAGELLAR FEVER IN MALIGNANT TERTIAN.

By ANDREW BUCHANAN, M.D.,  
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NEITHER Manson nor Celli nor any of the authors that we have seen, describe or mention anything regarding the fever that occurs about

the time that flagella are seen in malignant tertian cases.

Before giving a description of this fever we shall give a short account of the circumstances under which the observations which led to the discovery of this flagellar fever were made. For some months a systematic examination of the blood of all the cases admitted into the Nagpur Central Jail Hospital has been made, and five high power microscopes have been in almost constant use from early morning to late at night. Several medical men and ladies have helped in these investigations, especially Colonel Quayle, I.M.S., Dr. Agnes Henderson, Captain French, R.A.M.C., and Assistant-Surgeon Kane. Besides a number of intelligent Burman and a few Native prisoners have been trained to use the microscope, and they have become quite expert in detecting and distinguishing the various parasites.

While these observations were being carried on, there were several cases of quartan, benign tertian and malignant tertian fever as well as two cases of quotidian fever in Hospital. We propose to publish separately an account of these investigations, so at present we shall confine our remarks to the malignant tertian fever and chiefly to that part of the fever which we have not seen described elsewhere, *viz.*, the flagellar fever.

Manson says in regard to crescents that "the crescent body does not begin to show itself till it approaches maturity, about a week after the first crop of amoeboid parasites associated with the paroxysm has appeared," and this we have verified in many cases, but as regards the exflagellation Manson says:—

"In certain bloods exflagellation is easily procured; in others the opposite is the case. As regards the crescents, doubtless success depends in a measure on the degree of maturity of the parasite, young or effete crescents failing to evolve. There are other conditions affecting the process, however, which are as yet unknown."

The investigations which have been made here throw some new light on this point. While the investigations were being carried on a good many people (medical and non-medical) visited the Laboratory, and as we always tried to show them flagella we noticed that there was a certain stage when flagella could be found almost to a certainty. After the primary fever had disappeared there was an interval with low or only slight fever and then came a second rise of temperature, and when this fever comes on flagella can be found. We have not failed to find flagella in the blood of any case that has been examined during this period. This fever to which we have given the name of "Secondary" or "Flagellar" fever does not always occur, but even when it does not occur a few flagella will be found if the blood is carefully examined. If the temperature be high, more flagella will be found; if it be low, less will be found;

and if there be no fever, it may be difficult to find them. There is a distinct relationship between the amount of fever and the number of flagella to be seen, and therefore it would seem reasonable to consider that this fever is due to the flagellar bodies, and if it is, we have next to consider whether the fever may in any way be connected with the process of exflagellation. Now it has apparently hitherto been supposed that exflagellation takes place only without the body and after the blood has been drawn. There is no doubt that exflagellation is hastened by the withdrawal of blood from the body, but we have seen flagella bodies surrounded by phagocytes as soon as we could get the specimen under the microscope, and it is possible that the flagella may have been given out before the blood was drawn.

Manson speaking of the proneness to relapse in malignant tertian cases at page 66 says:—

"After apparent recovery from the fever there is great proneness to relapse at more or less definite intervals of from 8 to 14 days."

It is important to distinguish between the secondary fever or flagellar fever, that has been described above, and a relapse. A relapse conveys the idea of a repetition of the process that occurs in the original fever. The relapse in enteric and in relapsing fever are apparently a repetition of the original process, but the flagellar fever is quite different from the primary fever, for in the first place the tertian nature of the fever is not so evident as it is in the primary fever, and there is more frequently a rise of temperature daily, though not always, while it lasts, and in the second place the examination of the blood shows that the parasites are in a very different condition from what they had been in the primary fever. In the primary fever we find the ring forms, but in the flagellar fever the ring forms are only seen in small numbers if seen at all. Then another great point of distinction is that at the end of the primary fever we find crescents, whereas at the end of the secondary fever we find that the crescents have to a great extent if not entirely disappeared. The crescent appears to be something like a chrysalis stage, during which the flagella are developed, in the same way as the legs and wings of a mosquito are developed during the time that it is coiled up in the form which the name 'nympha' is applied. Now if the crescents are numerous at the beginning of the flagellar fever, and if they are in small numbers at the end of it; if the degree of fever tallies with the number of flagella bodies to be seen in the blood, and certainly in the cases that we have examined, we have found that the higher the fever, the larger the number of flagella that will be seen; if we find flagella bodies in freshly drawn blood, then it would seem to indicate a strong probability at least that the exflagellation may occur in the blood

before it is withdrawn from the human body, and to justify the introduction of the name which we have given to this particular stage of the fever, *viz.*, the "Flagellar fever."

It is true as most authors say that we very rarely find exflagellated bodies in freshly drawn blood, but we have seen hundreds of times how the phagocytes have a special antipathy to the flagella bodies, and how they come swooping down from a considerable distance to envelop and destroy the flagella body as soon as it begins to throw out flagella, so if the phagocyte can thus by some marvellous instinct (if the expression may be used in such a sense) lay hold of the flagella body when it is placed at a disadvantage, by being pressed under the cover-glass, how much more likely is it that the phagocyte would be able to catch the flagella body when it is free in the blood? If then the flagella body is captured by the phagocyte before the blood is drawn, this may account for the fact that we seldom see exflagellated bodies in freshly drawn blood.

It may be said that the phagocyte has a better opportunity of catching the flagella bodies when the blood is under the cover-glass, because the latter cannot move so easily as the former when they are in this position. The force of this argument must be admitted, and although we are not prepared to assert positively that exflagellation does take place within the body, still the arguments which have been given here, do seem to at least establish a probability that exflagellation may take place before the blood is drawn. At any rate we think that it is a point which deserves further consideration. Relapses do, however, occur at irregular intervals afterwards, and in these the ring forms are again found.

It is with some hesitation that we have ventured to advance this view regarding the occurrence of exflagellation within the body, because it is opposed to the view which Manson and Celli apparently hold. Manson says:—

"It is important to bear in mind that they are never seen in newly drawn blood, and that they come into view only after the slide has been mounted for some time—ten to thirty minutes, or even longer according to circumstances."

Manson's writings on malaria are crammed full of facts,—facts so numerous that after some months of constant observations we are astonished not only by their accuracy but by their number, so in venturing to disagree with so high an authority on this point we do so with some hesitation.

It was on the 4th of January that one of the most intelligent of our observers, Kya Thoung, remarked that "you always find flagella in crescent cases when fever comes on." Since that time we have examined many cases in order to test the truth of this statement, and we have found that there are three periods in a typical malignant tertian chart, and that each of these

periods corresponds with a particular stage of the parasite.

There is first the primary fever which may be a *clear tertian*—that is, with fever on alternate days only—or with fever on the intervening days also. After the first day or two, each successive paroxysm is less than the preceding one, so that if the highest temperatures are joined by a line, this line nearly always shows a "downward slope"—a marked contrast with untreated cases of benign tertian and quartan.

*2nd period*:—After the "downward slope" comes an interval of a few days, during which there is little or no fever, and then comes the

*3rd period*:—The flagellar fever, which may have a tertian appearance, but is not as "*clear*" a tertian as the primary fever as a rule, for we nearly always find some fever on the intervening days.

If we examine the parasites in these three stages we find in the

*1st period*:—Rings.

*2nd period*:—a very marked diminution in the number of ring forms, the crescents gradually increasing, and at the end of it a few flagella bodies.

In the *3rd period* we find ring forms very rare; crescents at first numerous and increasing, then decreasing and disappearing, almost, if not entirely; flagella bodies increasing, decreasing, and finally disappearing.

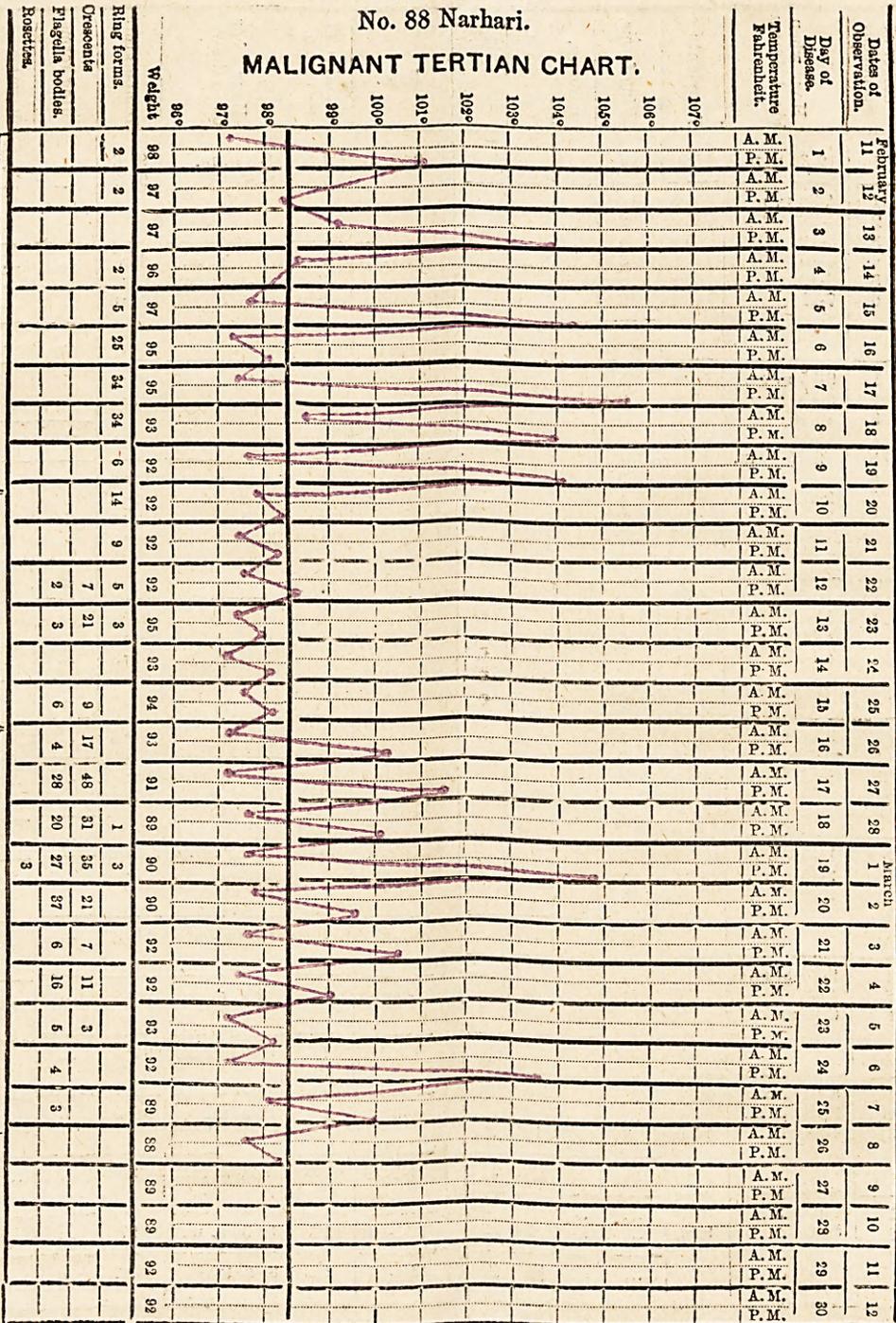
The primary fever is caused by the sexual sporulation of the rosette forms: the interval occurs at the time when the crescents are maturing: the secondary fever then comes on, and although it is contrary to the view held by Manson, Celli, Ross, Christy and others, still we believe that this part of the fever is caused by the breaking up of the crescents, or, in other words, that exflagellation does occur inside the body. We cannot examine the blood before it is drawn, and therefore we cannot see whether exflagellation does occur before the blood is drawn, but by examining the blood daily and noting the changes that occur we can draw inferences, and we would invite particular attention to the records of one case—the case of Narhari—and would ask whether any other reasonable explanation can be given for the alterations that occur, except the one which has been suggested here, *viz.*, that ring forms change into crescents, and that crescents change into flagella bodies before the blood is drawn.

In the table the results of the daily examinations are given, and in the chart the totals of the number of rings, crescents, &c., seen daily are entered. Allowance should be made for the fact that an equal length of time was not spent in examining the blood every day. The primary fever in this case is not typical for it does not show the downward slope.

The chart has been divided into three periods corresponding to the primary fever, the crescent

No. 88 Narhari.

MALIGNANT TERTIAN CHART.



Primary fever.

Crescent forming interval.

Flagellar fever.

## No. 88 Narhari

Date.	Number of specimen.	Hour when blood drawn.	Temperature.	Ring forms.	Rosettes.	Crescents.	Flagella bodies.	Date.	Number of specimen.	Hour when blood drawn.	Temperature.	Ring forms.	Rosettes.	Crescents.	Flagella bodies.					
16-2-01	1	12-30 p. m.	95.0	25	...	...	...	26-2-01	1	8-8 a. m.	97.6	...	...	5	4					
17-2-01	1	4-30 p. m.	105.8	14	...	...	...		2	9-30	97.0	...	...	12	...					
	2	4-36	105.8	2	...	...	...		27-2-01	1	11 a. m. 12-20 p. m. 2-25	98. 99. 101.6	...	...	8 23 17	8 13 7				
	3	5-10	105.0	4	...	...	...	2		...			...	...			...	...	...	...
	4	6-10	104.0	3	...	...	...	3		...			...	...			...	...	...	...
	5	6-40	103.4	8	...	...	...	...		...			...	...			...	...	...	...
	6	7-11	103.4	3	...	...	...	...	...	...	...	...	...	...	...	...				
				<b>34</b>	...	...	...					...	...	<b>48</b>	<b>28</b>					
18-2-01	1	9-15 a. m.	97.6	5	..	..	..	28-2-01	1	9 a. m.	97.4	...	...	13	6					
	2	9-45	97.0	2	...	...	...		2	11-45	97.0	1	...	18	14					
	3	10-40	97.2	3	...	...	...					<b>1</b>	...	<b>31</b>	<b>20</b>					
	4	11-20	97.6	2	...	...	...	1-3-01	1	8-30 a. m.	98.2	...	...	10	1					
	5	12-15 p. m.	97.4	4	...	...	...		2	12-35 p. m.	99.8	1	1	11	6					
	6	1	96.0	3	...	...	...		3	1-5	101.0	2	...	6	8					
	7	2-20	97.4	6	...	...	...		4	3-20	104.2	...	2	8	12					
	8	3-15	97.8	9	...	...	...						<b>3</b>	<b>3</b>	<b>35</b>	<b>27</b>				
				<b>34</b>	...	...	...						...	...	...	...				
19-2-01	1	10-30 a. m.	97.6	1	...	...	...	2-3-01	1	8-20 a. m.	98.2	...	...	5	16					
	2	11-10	98.6	5	...	...	...		2	10	97.4	...	...	9	12					
	3	4-30 p. m.	103.6	5	...	...	...		3	2-15 p. m.	97.8	...	...	7	9					
	4	4-50	103.6	...	...	...	...					...	...	<b>21</b>	<b>37</b>					
				<b>6</b>	...	...	...					...	...	...	...					
20-2-01	1	9-45 a. m.	98.2	3	...	...	...	3-3-01	1	9 a. m.	97.6	...	...	<b>7</b>	<b>6</b>					
	2	2-5 p. m.	97.6	7	...	...	...	4-3-01	1	7-30 a. m.	99.	...	...	5	7					
	3	4-20	98.0	4	...	...	...		2	1 p. m.	97.6	...	...	6	9					
				<b>14</b>	...	...	...					...	...	<b>11</b>	<b>16</b>					
21-2-01	1	11-50 a. m.	97.8	4	...	...	...	5-3-01	1	9 a. m.	97.6	...	...	3	5					
	2	2-15 p. m.	97.2	2	...	...	...		6-3-01	1	8-30 a. m.	98.8	...	...	...	4				
	3	2-40	97.4	3	...	...	...					...	...	...	...					
				<b>9</b>	...	...	...					...	...	...	...					
22-2-01	1	9-10 a. m.	98.	4	...	...	..	7-3-01	1	12 a. m.	100.	...	...	...	3					
	2	12-0	97.6	1	...	3	1		9-3-01	1	12-26 p. m.	97.6	...	...	3	2				
	3	6 p. m.	97.6	...	...	4	1					...	...	...	...					
				<b>5</b>	...	<b>7</b>	<b>2</b>					...	...	...	...					
23-2-01	1	8-10 a. m.	97.6	...	...	5	3	10-3-01	1	11 a. m.	98.0	...	...	2	3					
	2	12-35 p. m.	97.4	...	...	6	..		11-3-01	1	7-20 a. m.	97.	...	...	3	...				
	3	4-35	97.6	3	...	10	...					...	...	...	...					
				<b>3</b>	...	<b>21</b>	<b>3</b>					...	...	...	...					
25-2-01	1	4 p. m.	97.6	...	...	2	3	12-3-01	1	11-30 a. m.	97.	...	...	3	2					
	2	5-30	97.4	...	...	7	3		13-3-01	1	8 a. m.	97.2	...	...	2	1				
				...	...	<b>9</b>	<b>6</b>					...	...	...	...					

Each examination lasted 20 minutes. The daily totals are put in black figures.

forming interval, and the flagellar fever. If we further subdivide the third period into three subperiods, and then count the numbers of the different kinds of parasite seen in each period or subperiod we shall find the totals as follows:—

Form of Parasites	1st		2nd		3rd	
	a	a	a	b	c	
Ring forms	110	31	4	0	0	
Crescents	0	37	131	39	3	
Flagella bodies	0	11	79	59	12	

There were no crescents or flagellar bodies in the first period, although 110 ring forms were found. Crescents appear in the second period and a few flagella bodies, but most of these were seen on the evening before the flagellar fever came on.

It is the third period to which special attention is invited. Note how the crescents soon begin to diminish in number, and note how in the first subperiod the crescents are nearly double the number of the flagellar bodies, while in the second subperiod the flagella bodies outnumber the crescents, and in the third subperiod the flagella bodies are four times as numerous as the crescents.

The crescents disappear—there will be a few remaining as there will be a few green stalks in a field of ripe corn—the flagella bodies also disappear,—but notice how the numbers in respect to each other alter—the crescents being at first in the majority, the flagella bodies being afterwards in the majority. Can any other reasonable explanation be offered to explain this change in numbers except the one which has been put forward now, *viz.*, that the crescents have been converted into flagella bodies before the blood had been drawn?

A phagocyte never attacks a crescent, and if the crescent is not converted into a flagella body, where does it disappear to, and how is it disposed of? A phagocyte attacks a flagella body in the most marvellous way: can we believe that a cell which performs a function of this kind when the blood has been drawn has not got a similar function to perform while it is still within the body?

If we examine the record we find on the evening of the 1st March and the morning of the 2nd March that the number of flagella bodies was 12 plus 16, and the number of crescents seen in the same slides was 8 plus 5, so that 28 flagella bodies were seen while 13 crescents were counted. Up to the 1st March the crescents outnumbered the flagella bodies. We think it is a fair inference to draw that exflagellation was at its maximum on the evening or night of the 1st March. What was the

temperature on that evening? It was the highest during this part of the fever and why? Was it due to the breaking up of rosettes and the invasion of blood corpuscles by the spores? Or was it due to the exflagellation?

It is true that a small number of rosettes and ring forms were seen, but as we said above you always find a few green stalks in a ripe field of corn; it is also true that 150 flagella bodies were counted in the third stage, while only 4 ring forms were found, and that 110 ring forms were found in the primary fever, and not one flagella body was found. If the secondary fever was not due to some different process from that which took place in the primary fever, how can the alteration in the condition of the parasites which were observed be explained?

Had the statement, that exflagellation takes place only after the blood has been drawn, not been made by many high authorities, we think that the observations recorded above would carry conviction that exflagellation does take place inside the human body, but further evidence in favour of this view can be given from observations which have been made on sparrows' blood, and also from the records of observations which have been made by Stephens and Christophers in Lagos on the West Coast of Africa, but these will be considered later.

### STRICTURE OF THE URETHRA : ITS OPERATIVE TREATMENT AND GENERAL MANAGEMENT.

(Lectures delivered at the Medical Graduates' College,\*  
London, November 1900.)

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#### PART I.

GENTLEMEN,—I propose directing your attention to-day to stricture of the urethra. It is, perhaps, the most important of the surgical disorders of the genito-urinary organs. It is the most common of those diseases that you are called on to deal with in practice, since at one or other period of life the vast majority of the male population suffers from that condition which most frequently gives rise to it. If neglected or improperly treated it is the most far-reaching in its injurious consequences, though the morbid pathological changes thereby induced.

A detailed description of the anatomy of the urethra would be foreign to the scope of these lectures.

Stricture of the urethra, as its name implies, consists in an abnormal diminution of the calibre of the canal at some particular part; or,

\* Sent for publication by author.