

effectually neutralised is that in the blood and lymph. Antitoxin is transported by the lymph and the blood; it is not taken up by the nerves, and there is no reason for thinking that it ever gets into nerve cells. It does not pass in any large proportion into the cerebro-spinal fluid after intravenous injection. Even in highly immunised animals the antitoxin in the cerebro-spinal fluid is more than a hundred times less per cubic centimetre than in the blood. Naturally, antitoxin injected into the subarachnoid space would neutralise any toxin which might be there. Moreover, as antitoxin passes very rapidly out of the cerebro-spinal fluid into the blood stream, it would, if in excess, neutralise any toxin in the circulation.

The therapeutic use of antitoxin is, however, fully justified, nay, imperative, because in any given case it is impossible to say whether the toxic dose already in the nervous system is or is not a fatal one; the prompt use of antitoxin may neutralise just that last amount of toxin in the blood which, if it had got into the nervous system, would turn the balance against the patient.

The great question still undecided is how best to apply the antitoxin therapeutically. The answer can only be given after detailed examination of a large number of carefully classified cases. In the therapeutic use of antitoxin everything depends upon time, and hence the immense importance of careful search for the earliest symptoms and the unhesitating employment of serum upon their recognition.

ANALYSIS OF 102 CONSECUTIVE CASES OF TETANUS

TREATED AT SIR J. J. HOSPITAL, BOMBAY, INDIA, FROM OCTOBER, 1915, TO JULY 31st, 1917.

By NAVROJI ARDESHIR COOPER, B.A., B.Hy., M.D. BOMBAY.

It will, I think, not be out of place to say a few words as to how this disease is regarded here by the poor and ignorant classes.

Nature of Cases and Results of Treatment.

All the tetanus cases that came under my treatment belonged to the labouring classes, who are generally very poor, illiterate, and completely ignorant of the grave nature of the disease; further, they are highly superstitious. As a class they do not, in most cases, come to the hospital for prompt treatment as soon as tetanus occurs, for it appears to be their common belief that this disease is the outcome of the wrath of some evil spirit or witch. Naturally, therefore, in accordance with their custom, they invoke the help of the gods and goddesses by propitiation and religious offerings through the so-called professional "magicians," whom these highly credulous people believe to be experts in the cure of this disease. Moreover, they seem to suppose that these persons possess the necessary physical and hypnotic control over the evil spirits, who, it is imagined, cause this disease. Thus it is that they suffer the "magicians" to do all sorts of things and even at times to strike the patients ruthlessly in order "to cast off spirits" from their bodies. The result is that they are not brought to the hospital for treatment until their condition has become either worse or hopeless. Out of 102 cases treated during the period of nearly two years, 27 died within a few hours after admission. All these 27 cases were not seen by me, as they were admitted after I had left the hospital for the day.

Of the remaining 75 cases (see Table I.), two had to be discharged against advice, 42 recovered, and 31 died, as follows:—Died within a few hours, 4; within 24 hours, 9; within 48 hours, 7; within 3 to 5 days, 5; died of pneumonia (food), 2; died of hyperpyrexia, 1; died in 6 to 7 days, 3.

Under the treatment described below some of the worst cases have yielded very readily—cases occurring a few hours to a few days after infection, accompanied by very severe spasms and intense agonising pains in the muscles, &c., and with but short remissions between the spasms. The results have been so encouraging that I place them before the medical profession in the hope that attention, particularly of medical men in charge of tetanus hospitals, may be drawn to the combined treatment.

I cannot but point out here some inconveniences. First comes the unsuitable position of the tetanus wards. The arrangements to exclude light and air are poor. Noise is heard at times the whole day from an iron workshop about a dozen yards away, and morning and evening numbers of bullock carts pass near the wards. Secondly, there are too frequent changes of nurses, who are at times removed when they have begun to be useful, and new ones have to be trained. Last, but not least, is the difficulty of getting the required drugs (at times even simple drugs), let alone the antitetanic serum and the necessary apparatus. In spite of all this, I have been able to achieve results which appear to be the best hitherto obtained here, and I presume that my treatment, if judiciously made use of, may produce still better results.

TABLE I.—Method of Treatment of 75 Cases with Results.  
1. Treatment by drugs—e.g., sedatives and hypnotics.

Total cases.	Died.	Recovered.	Mortality %	Recovered %
16*	9 { 6 most severe. 2 very severe. 1 severe.	7 { 1 very severe. 5 not severe. 1 chronic.	56.2	43.7
* 1 discharged against advice (was improving).				
2. Treatment by carbolic acid injections, sedatives, and hypnotics.				
12	8 { 4 most severe. 1 very severe. 3 severe.	4 { 2 very severe. 2 severe.	66.6	33.3
3. Treatment by carbolic acid injections, antitetanic serum, sedatives, and hypnotics.				
4	2—very severe.	2 { 1 severe. 1 not severe.	50.0	50.0
4. Treatment by antitetanic serum, sedatives, hypnotics, and chloretone rectal injections.				
20†	8 { 1 most severe. 6 very severe. 1 severe.	12 { 2 severe. 1 chronic. 6 not severe. 3 very severe.	40.0	60.0
† 1 very severe (discharged against advice).				
5. Treatment by chloral hydrate intravenously, sedatives, hypnotics, and chloretone enema injections.				
4	2—very severe.	2 { 1 very severe. 1 not severe.	50.0	50.0
6. Treatment by antitetanic serum, chloral hydrate intravenously, sedatives, hypnotics and chloretone rectal injections. (Special combined treatment.)				
17	2—very severe.	15 { 2 most severe. 7 very severe. 6 severe.	11.7	88.2

All these 102 cases had never had a dose of prophylactic antitetanic serum.

The results of the tetanus cases treated at the J. J. Hospital (as per hospital registers) from 1910 are given in Table II.

TABLE II.—Tetanus Cases at J. J. Hospital from 1910-17.

Years.	Cases treated.	Died.	Recovered.	Other-wise.	Recovered, percent.
1910-1911 ... ..	45	33	9	3†	20.0
1912-1913 ... ..	70	40	23	7‡	32.8
1914-1915, up till September ...	78	48	29	1§	37.9
1915, October, to 1917, July ...	102	31	42*	28	42.0

\* 1 discharged against advice (was improving). † 1 discharged as requested, 2 no notes as to what became of them. ‡ 6 no notes, &c., 1 discharged in one day as cured? § 1 no notes, &c. || 27 not seen, 1 discharged against advice (very severe).

It will be seen that the admissions are increasing every year and also that there is a corresponding improvement in the recoveries. Yet I feel sure that better results will be secured in future if greater facilities are afforded to the medical officer in charge of these cases.

Clinical Remarks.

My own experience in the use of antitoxin as a prophylactic is nil, for I have never had a chance of using it as such. However, the various reports speak very highly of it, if properly given and in sufficient doses, combined with necessary drugs, injections, &c., together with proper nursing.

I have noticed in a few cases very persistent spastic rigidity of the wounded limb with tetanic spasms. This rigidity remained for days together, though the spasms stopped after a few days. In two cases of spastic rigidity of the wounded limb I noted the relaxation in it after intranervine injections of antitetanic serum. In one case of trismus, treated with drugs only, there was no improvement for days together, until two intravenous injections of antitetanic serum produced the desired effects. Purely local tetanus cases I have never had occasion to see, but a case with trismus of the jaw did occur in my experience with fatal results within a few hours. The patient had a wound in the chin and was intensely anæmic.

The mortality in tetanus cases increases with the involvement of higher centres and the earlier appearance of the disease after infection.

The symptoms are produced according to the parts of the nervous system involved.

The most susceptible centres that suffer earliest are those of the pons and medulla. When the site of infection is near the cranial nerves they suffer directly and early, or sometimes through the blood stream in an indirect way. Hence the antitoxin that circulates in the blood acts better in protecting the higher centres from further damage to them than the spinal ones directly accessible from the wound. Here, therefore, comes the importance of intravenous injections of antitetanic serum in tetanus cases.

Many of my tetanus cases had no evidence of any injury on their bodies, though some of them were cases in their worst forms. The explanation for this is that those patients had been injured weeks or months ago, but that the bacillus or spore implanted in the wound did not germinate into a number of bacilli with production of toxin for a very long period, though the wound healed up completely, until it found favourable conditions for its growth. Hence the so-called idiopathic cases of tetanus.

#### Details of Treatment.

In a fairly developed adult patient with severe form of tetanus I give the following treatment:—

℞ Chloral hydrat. ... gr. xx	℞ Chloretone ... gr. xxx
Pot. bromid. ... gr. xx	Olive oil. ... 3 iv
Tr. digitalis ... m. x	Per rectal injection twice a day.
Tr. hyoscyami ... m. xx	
Spt. chloroformi. ... m. x	℞ Calomel ... gr. v
Aq. chloroform. ... 3 i	Sod. bicarb. ... gr. x
Every four hours.	One at bed-time when required.

About 30 to 40 c.c. chloral hydrate, 5 per cent. sterilised, intravenously daily until sound sleep is produced and spasms become less.

Antitetanic serum 3000 units or more intravenously daily until the spasms have stopped. Sometimes with very severe spastic rigidity it is given for a few days, though in small quantities.

Chloral hydrate intravenously and chloretone per rectum are given daily, until contra-indicated. When they produce detrimental effects on the heart, or the heart sounds become feeble or the patient becomes very low they are completely omitted and the mixture too is changed by the replacement of chloral hydrate and pot. bromide by ammon. bromide, caffein. citras, &c. Alcohol, pituitrin, adrenalin, morphia, camphor and olive oil, &c., are given by mouth or by injections as required. Other complications are treated on ordinary lines.

Bombay.

#### CORNWALL COUNTY COUNCIL AND TUBERCULOSIS.—

The Cornwall County Council has decided to equip and maintain Tehidy mansion as a sanatorium for tuberculosis, provided the residents of Cornwall will purchase the property and present it as a "war memorial" to the county council. The Tehidy estate, comprising 250 acres, can be purchased for £10,000. The scheme has been warmly taken up, £7000 have been already subscribed, and there is no doubt but that the whole of the sum required will be raised.

THE LATE DR. F. E. WALKER.—Frederick Edward Walker, M.B., B.S. Lond., whose death occurred on Dec. 7th, at Uxbridge, at the age of 43 years, served as civil surgeon during the South African war, attached to the 3rd Durham Light Infantry, receiving the Queen's medal and three clasps. In addition to the work of a busy general practice, he held posts on various public bodies. He was a member of the urban district council and captain of the local fire brigade. Dr. Walker leaves a widow and two young children.

## ON CERTAIN FORMS OF ALBUMINURIA AND POLYURIA: THEIR CAUSE AND CURE.

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DURING the last few years a good deal has been written on the subject of two varieties of albuminuria—namely, the lordotic and the orthostatic—and on functional polyuria, and various theories have been put forward as to the cause of these conditions. Most observers are agreed that there must be faulty innervation of the nerves of the kidney, either in the form of vaso-motor disturbance or neurosis of the abdominal sympathetic. But no one, as far as I know, has been able to advance any explanation as to why such nerve derangements should result and persist.

#### Causat.

I have examined a considerable number of such cases, and have come to the conclusion that in many of them the original cause of the albuminuria or polyuria is to be looked for in irritability of varying intensity, causing persistent contraction, of certain of the muscles in the renal area—i.e., psoas, erector spinæ, and, to a less extent, the quadratus lumborum.

The method by which these muscular contractions produce disturbance in the kidney function is by irritation of the renal sympathetic nerves, either directly through the psoas and quadratus on which these nerves lie, or indirectly through the erector spinæ affecting the posterior dorsal nerves. The connexions between the latter and the kidney have been studied anatomically, physiologically, and therapeutically.

This theory of muscular irritability also explains why the recumbent position brings about improvement in the albuminuria or polyuria, as the case may be. It does so by causing a greater or less degree of relaxation in the contracted muscles, whereby the irritation of the renal sympathetic is proportionally reduced. Incidentally also the theory of psoas contraction as a cause of lordotic albuminuria explains how, when the recumbent position has removed the albumin, it sometimes reappears when a cushion is placed under the lumbar vertebræ so as passively to reproduce the lordosis. This latter position causes elongation of the psoas, and this in its already irritated state is sufficient to cause it to contract, a state of matters which would not obtain in normal subjects.

These irritative muscular states may be primary, and are then generally of rheumatic or traumatic origin, or secondary to articular, ligamentous, or cartilaginous disturbance in the vertebræ; the spinal column can be affected by joint synovitis, slight displacement of bones or cartilages, just as joints elsewhere.<sup>1</sup>

This leads me to say a few words from the view of cause and effect about visceral disease and their "referred pains." At the present day, if a tender spot be found in any spinal area corresponding to a particular viscus, the tendency is to take it for granted that the tender spinal area is a "referred pain," and is secondary to the visceral lesion. I consider that not infrequently the opposite is the case—i.e., that these pains are not "referred," but are really the manifestation of the cause, or one of the causes—namely, irritated erector spinæ states. Of course, in advanced cases vicious circles are easily, in fact usually, set up.

#### Illustrative Cases.

The identification of these muscular contractions as one of the exciting causes of certain forms of kidney disease is, of course, of value therapeutically, as one of the important factors in cure or amelioration is the removal of such contractions. The effect of limiting the treatment to this alone can be seen in the two illustrative cases, both of officers treated in the Swedish War Hospital, though I must add that I nearly always in addition employ kidney vibrations, frictions on the nerves in the affected area, active exercises, &c., according to the methods of the late Henrik Kellgren, as thereby the best results are obtained.

CASE 1.—Lieutenant —, aged 48, was admitted on Jan. 28th, 1917, suffering from the after-effects of an attack of hæmaturia.