diseases, paresis and tabes dorsalis. While syphilis as the underlying cause of both paresis and tabes has long been recognized, it is only within comparatively recent years that the same factor has been invoked to explain these and certain other cases of aortic regurgitation. Thus, in 1902, Fabris¹⁷ pointed out that syphilitic aortitis not uncommonly eventuates in simple dilatation of the aorta, or in actual thickening and retraction of the aortic cusps as a result of downward extension of the inflammatory process, producing, in either event, phenomena referable to insufficiency at the aortic orifice. This observation has since been confirmed by Saathoof,¹⁸ Mönckeberg,¹⁹ Longcope²⁰ and others. In Longcope's series of seventy-six uncomplicated cases of chronic aortic valvulitis, twenty-one, or 34 per cent., were associated with syphilitic aortitis. In our series, nineteen, or 27 per cent., were attended by sclerosis and retraction of the aortic valves.

SUMMARY

1. The mesaortitis of Heller and Döhle is essentially a syphilitic lesion, but its production is favored by certain other factors, among which age, sex, the length and character of antisyphilitic treatment, intercurrent disease, especially infections such as acute rheumatic arthritis, alcoholism, and occupations necessitating prolonged physical strain play a not unimportant rôle.

2. (a) Syphilitic aortitis occurs most often in males—in 80 per cent. of our series—a fact which assumes additional importance when taken in connection with occupational influences.

(b) Syphilitic aortitis is a lesion of comparative youth, occurring oftenest between the ages of 30 and 50 years—in 71.4 per cent. of our cases.

(c) In untreated or neglected syphilis, the average interval between infection and death with anatomic confirmation of the existence of syphilitic aortitis is 20.5 years, from which fact it is apparent that, even in the least favorable circumstances, the lesion arises late in the course of syphilis.

3. (a) About 30 per cent. of all patients with syphilitic aortitis develop aneurysm.

(b) At least 15 per cent. of all cases of syphilitic aortitis are attended by dilatation of the first portion of the aorta.

(c) About 30 per cent. of all cases of syphilitic aortitis eventuate in sclerosis and retraction of the aortic valves.

(d) Leaving out of consideration the occurrence of such clinical phenomena as angina pectoris and cerebral disturbances referable to occlusion of one of the larger branches of the aorta, such as the innominate or left carotid artery, it appears to be probable that few cases of syphilitic aortitis pursue a course free from subjectively appreciable or even detectable clinical manifestations.

17. Fabris: *Gaz. méd. ital.*, 1902. Kaufmann, *Spez. Path. Anat.*, Ed. 6, p. 78.

18. Saathoof: *München. med. Wchnschr.*, 1906, liii, 2050.

19. Mönckeberg: *Med. Klin.*, 1905, i, 1027.

20. Longcope, W. T.: *The Association of Aortic Insufficiency with Syphilitic Aortitis*, *THE JOURNAL A. M. A.*, Jan. 8, 1910, p. 118.

The Barrel Chest.—Nothing is less like a barrel than the "barrel chest." Its most striking characteristic is its greatly increased anteroposterior diameter, so that it approaches the form of the infant's chest.—Richard C. Cabot.

THE REACTIONS AND RESULTS OF TREATMENT IN CEREBROSPINAL SYPHILIS

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The purpose of this paper is to present the relationship between the discomforts from intravenous-intraspinal treatment and the results in terms of the individual's increased or restored economic value to the community.

The material on which the following observations are made consists of thirty-eight cases, watched over periods varying from three months to three years. Fortunately the variety in clinical types has been especially great, so that in this small series almost all the classical forms as well as numerous unusual examples of cerebrospinal syphilis appear. To these thirty-eight patients were given 1,126 intravenous injections and 355 intraspinal injections of medicated serum.

The technic of administration was the usual one. The spacing of the doses was varied with the individual. On the basis that it was desirable to give every patient the maximum amount of the drug, each was started on a weekly injection, usually following a couple of weeks' mercury preparations, of 0.3 gm. of salvarsan, increasing from 0.4 in the early stages of the work to 0.6 gm.

DISTURBANCES

In considering the question of distress to the patient caused by the intravenous injections, every subjective and objective change from normal conditions, no matter how trivial, has been recorded. Table 1 shows the different kinds of reactions met and their relative frequency. Obviously the most frequent is the so-called anaphylactoid phenomenon appearing as slight flushing of the face, urticaria, or more severe shock. This is a remarkable occurrence and one which deserves special consideration. About 55 per cent. of all the cases show the condition at one time or another during the treatment, but in the total of 1,126 injections, its incidence is about seventy-three, or 6.5 per cent. It has occurred both in men and in women, and the age of the subject seems to have no bearing. In most cases the phenomenon occurs at or after the fourth injection, rarely at the second, never at the first.

TABLE 1.—DIFFERENT KINDS AND RELATIVE FREQUENCY OF REACTIONS

Reactions	Number	Per Cent.
Slight flushing	39	3.46
Acute shock	34	3.1
Urticaria	12	1.1
Nausea	13	1.2
Vomiting	30	2.7
Diarrhea	13	1.1
Chill	7	0.6
Malaise	14	1.3
Pain increase	4	0.3
Pain or swelling in veins	5	0.4
Thrombosis	3	0.2
Jaundice	2	0.1
Dermatitis (AS)	2	0.1
Herkheimer (rash or nodes)	10	0.9
Edema	1	0.09

Usually if the reaction has not appeared in a given individual by the fourth or fifth injection, it does not occur. In one exception it showed first at the tenth injection. When the patient has had one reaction—that is, has become hypersensitive to the drug—the chances are great that each subsequent treatment will be accompanied by the phenomenon in greater or less

severity. Many patients presenting this condition of hypersensibility report tasting or smelling the drug almost instantly after the inflow into the vein begins.

The symptoms of this curious phenomenon vary considerably in intensity but follow a very constant type. In the mildest cases there is simply a faint suffusion of the face, so slight that it passes unnoticed by the patient. More striking are the examples in which subjective sensations of an unaccustomed and often distressing nature cause the patient to move restlessly and cough once or twice, or draw a deep breath. Usually a suffusion of the conjunctival vessels precedes this restlessness and gives warning of an approaching reaction. The patient stops talking and begins to move his head a little from side to side, clears the throat frequently, and then often says with rather a suppressed voice, "I feel sort of queer." The suffusion deepens rapidly and the face swells, and the red color changes to cyanosis, and occasionally almost blue. A little later the blueness gives place to ashen gray, which may be of an extreme grade. While the color changes are passing over the face the respirations are short and rapid, and the patient is evidently working hard to get as much air as he wants. He complains of a sense of oppression beneath the sternum and occasionally of feeling his heart beat heavily. As a matter of fact, the cardiac action remains undisturbed in many cases throughout the reaction, though great pulse weakness is met occasionally. The whole disturbance lasts from three to five minutes and passes off gradually, leaving the patient rather limp and discouraged. Very frequently vomiting occurs during the succeeding hours. Blotchy, urticarialike spots have appeared in two or three cases almost immediately after the termination of the shock.

To a certain extent the disturbance may be prevented by very slow administration of the drug. Indeed, with some cases one may cause the shock to appear or disappear merely by starting and stopping the inflowing salvarsan. Other methods have been suggested for the control of this reaction, such as epinephrin given intramuscularly ten minutes before the treatment, and $\frac{1}{100}$ grain of atropin during the shock. While in some cases the remainder of the injection can be given, by pausing for five or ten minutes, it has been recently my habit to stop the injection the moment symptoms begin to appear. This reaction is undoubtedly the worst that patients have, and while it is usually of trivial significance, it may be of very serious nature. In one case not in this series, breathing stopped entirely and artificial respiration was effectively resorted to. Not infrequently urticarial eruptions appear within five to ten minutes. That the nature of this strange reaction is anaphylactic there seems to be little question. Many clinical observers have noted these symptoms, and Swift,¹ in a conclusive series of animal experiments, has demonstrated that the combination of guinea-pig serum and salvarsan produces a substance capable of sensitizing and then shocking the guinea-pig. By the addition of salvarsan, the homologous serum developed the characteristics of a foreign protein.

The other kinds of reactions finding place in Table 1 are very infrequent, gastro-intestinal upsets being the commonest. Vomiting occurred in 2.7 and diarrhea in 1.1 per cent. of the cases. The former usually occurs

within five or six hours after the injection, and is associated with the latter. Because these gastro-intestinal upsets appear only in certain individuals, and following the administration of anything more than a small or limited dose, it has seemed to me that they were purely arsenical toxic effects.

The other undesirable effects are so slight and infrequent as to make discussion of them unnecessary.

DISCOMFORTS

Turning now to the discomforts incident to the intraspinal treatment with salvarsanized serum, we find a great array of reactions, as shown in Table 2. First of all, pain stands out definitely ahead of all others. This pain varies in intensity from slight twinges to severe wracking pain which can be controlled only by morphin. Fortunately this end of the scale numbers but few victims, but the middle degrees are felt by a great majority of the patients. In a total of 355 injections there were 104 reactions of all sorts (26.4 per cent.); of these, seventy-eight (19.1 per cent.) were painful. If the number of patients is considered rather than the number of injections, it is seen that 80 per cent. have pain, not at every injection necessarily, but at some time during their course of treatment.

TABLE 2.—DISCOMFORTS INCIDENT TO THE INTRASPINAL TREATMENT WITH SALVARSAN SERUM

	Number	Per Cent.
Total injections	355	...
Total reactions	104	26.4
Pain in the legs	59	13.8
Headache	19	5.3
Odd sensations in the legs	5	1.4
Numbness in legs and perineum	5	1.4
Nausea	3	.8
Vomiting	7	1.9
Coma	1	.3
Vesicle paresis	1	.3
Paraplegia	1	.3
Increased ataxia	2	.5
Sensations in head	1	.3
Weakness	1	.3
Psychic exaltation	1	.3

The pain may occur at various periods in the whole procedure and in various parts of the body. Occasionally a sharp lancinating pain is felt at the moment of puncture. This pain shoots down one or both legs and often to the testicles. It is momentary and is often spoken of by the patient as an electric shock. Whatever the cause—possibly piercing a nerve fiber—it is not very frequent.

The second type of painful reaction is that in which the pain begins during the time of inflow of serum. It is occasionally felt in the sciatic region, occasionally at the site of puncture. Rarely severe, it lasts only a minute or two, and passes off as insidiously as it began. It has never been severe enough to cause the patient to urge that the treatment be suspended.

The third type is perhaps as common as any, and consists of pain appearing within a few minutes after the serum has run in and the needle has been withdrawn. This pain often is fairly severe, usually felt in the thighs, sometimes in the calves and feet. If untreated it may last several minutes and disappear spontaneously, or it may linger for half an hour or longer. Sometimes it comes and goes with more or less severity during the night following treatment. The treatment of this type will be considered later.

The fourth type differs from the preceding in that it occurs only in cases of painful tabes and consists in an exacerbation of the particular individual's special pains. These stimulated pains may be very bothersome for several days after the treatment.

1. Swift, H. F.: Anaphylaxis to Salvarsan, *THE JOURNAL A. M. A.*, Oct. 5, 1912, p. 1236; Intraspinal Therapy in Syphilis of the Central Nervous System, *ibid.*, July 17, 1915, p. 209.

The fifth type is more serious, and a part of a general reaction of considerable severity. In this group there is usually no pain at the time of the injection or following it for several hours. Then the patient begins to feel chilly and uncomfortable, and there is general malaise and headache. Soon a moderate temperature rises. The headache is violent, and the pains in the back and legs often become intense. Objectively the patient presents the picture of meningism. The neck is stiff and Kernig's sign present in more or less completeness.

In one of the three cases coma supervened. The cerebrospinal fluid in this case and in one of the severe instances of Group 3 was examined within from six to eight hours after the serum injection. Both fluids showed a slight serum discoloration and a great increase of cells, over 2,000 in one case and as high as 30,000 per cubic millimeter in the other. These cells are not true polynuclears, but multilobed cells, probably of the class described by Pappenheim as the macrophagic clasmatocytes of Marchand, having their origin in the tissues and not from the blood.

The explanation of the cause of the pain in the different groups can be, of course, only hypnotic. Two suggest themselves:

1. Irritation, either chemical or physical, or both. It has been thought that pain was less frequent when serum diluted with saline was used — say, a 40 or 50 per cent. serum — than when pure 100 per cent. serum was injected. For the past two years only pure serum had been used in this series. Before that time 40 or 50 per cent. serum was given. It does not seem to me that pain is any more noticeable now than in the previous period.

Autosalvarsanized serum and serum prepared by Ogilvie's² method, provided not over 0.00025 gm. is added, are equally irritating or nonirritating as the case may be. Serum, however, to which mercury has been added by Byrne's³ method, seems to have been more irritating than the salvarsanized preparation. This statement must be taken with reservation though, because the number of mercurialized injections in this series is small.

2. The other suggestion for explaining the very severe reactions is that they are anaphylactic in nature. If the demonstration be true that salvarsanized guinea-pig serum behaves as a foreign protein to that animal, it is quite possible that the same thing may be true of man. Furthermore, Gay,⁴ Besredka⁵ and others have demonstrated that animals may be both sensitized and shocked by the subdural route.

Recently the plan to provide a stock mercurialized horse serum has been brought forward, the idea being to give the physician a convenient serum preparation for intraspinal injection. The undesirability of such a serum is obvious. It has been shown that even a homologous serum can be rendered as dangerous as a foreign protein by the addition of salvarsan (Swift¹), and on this basis some of the rare and severe reactions following intraspinal injection with salvarsanized human serum have been explained as anaphylactic in nature. Furthermore, there is another aspect of the

problem which suggests itself. Longcope⁶ showed that repeated injections of foreign protein, which produced successive sublethal anaphylactic shocks, caused definite tissue change in heart and kidneys. In view of these facts, the wisdom of repeated intraspinal injections of foreign serum should be gravely questioned.

That the cause of the pain and general reaction is a transient one, at least so far as visible lesions of the membrane and cord are concerned, is demonstrated by the one opportunity presented at necropsy to view the spinal canal. The patient had received forty-one intraspinal injections of 100 per cent. serum in twenty-six months. The outer surfaces of the cord and membranes were smooth, pale and glistening as normal throughout their entire length. The microscopic sections of the cord are not yet ready for inspection.

In most cases the pain is so transient and light that no treatment is needed. When the pains following the injection immediately (Group 3) are severe, deep muscular massage of thighs and calves relieves it magically. The specialized pains (Group 4) in painful tabetics are best controlled by heat to the lumbar spine and along the course of pain, and by the administration of phenacetin, pyramidon, and caffeine and codein. Very rarely morphin is needed.

In the extremely rare cases, puncture may be necessary to relieve the pain.

In Table 2, "odd sensations in the legs" refers to certain sensations described vaguely by a few patients. These sensations do not amount to pain, but are sufficiently uncomfortable to attract the subject's attention. The next group, "numbness in legs and perineum," is a perfectly definite sequel to introducing directly too much salvarsan or neosalvarsan. Several French observers reported that they had seen this curious numbness usually associated with retention of urine. The symptoms persist for a long period of time, and in two or three cases appear to be permanent.

It is obvious, therefore, that the intravenous-intraspinal method of treatment is not devoid of difficulties for the patient. But perhaps a fair criterion of the real importance of the distressing features of the method is the willingness of the patients to subject themselves repeatedly, over a long period of time, to the intraspinal injections. In only a few instances has it been evident that the patients dreaded the treatment. With very many cases there is practically no discomfort worth recording; but in a fair proportion the treatment is distinctly of a heroic nature.

BENEFITS FROM THE TREATMENT

When we come to consider how much good the patients derive from the intensive treatment under discussion, it is necessary to determine some state of being which can be looked on as a goal worth reaching. Working capacity, or the individual's economic value to the community, is undoubtedly the severest test to which human beings are put. By their response to this trial they succeed or fail in the struggle of life. The question arises, therefore, How well have these patients been helped to return part way or wholly to their level of usefulness?

At the outset, in the various forms of cerebrospinal syphilis, we are faced with two symptom-producing and incapacitating factors. In the first place, most of the cases have been of long standing so that some degree of destruction of nerve tissue may be assumed. Secondly,

2. Ogilvie, H. S.: The Intraspinal Treatment of Syphilis of the Central Nervous System with Salvarsanized Serum of Standard Strength, *THE JOURNAL A. M. A.*, Nov. 28, 1914, p. 1936.

3. Byrne, C. M.: The Intradural Administration of Mercurialized Serum in the Treatment of Cerebrospinal Syphilis, *THE JOURNAL A. M. A.*, Dec. 19, 1914, p. 2182.

4. Gay, Southard and Fitzgerald: *Jour. Exper. Med.*, 1909, xxi, 21.

5. Besredka and Lissowsky: *Compt. rend. Soc. de Biol.*, 1910, lxxviii.

6. Longcope, W. T.: The Effect of Repeated Injections of Foreign Protein on the Heart Muscle, *Arch. Int. Med.*, June, 1915, p. 1079.

there is a factor of the presence in the tissue of the active spirochete and its toxins. Obviously, symptoms due to the former cause are not remediable by chemoserotherapy, though exercise and reeducation of muscle groups may help considerably. But it appears that, even in cases of long standing, there is often a large factor of active syphilis. If this be removed by adequate treatment, there is frequently surprisingly little disability left which is dependent on chronic change. Perhaps the shortest and clearest way to demonstrate what has been done with these thirty-eight cases is to present the results in a small table, as Table 3.

The loss of working capacity depends in the different types on various factors. In those cases with cerebral involvement in which the symptoms are psychic disturbances, the individual may become useless in his work most insidiously. Several patients have told me of lack of concentration or especially of lack of power to make decisions. In the latter instance a man goes on from time to time putting aside decisions, often making elaborate explanations in his own mind why the point at issue had better be postponed temporarily. At first this procrastination of decisive mental effort passes unnoticed by the office force, but gradually becomes not merely apparent but also embarrassing to the patient's co-workers. So his usefulness is little by little undermined until one day he finds that he cannot even do the routine and becomes almost dazed. Such cases are frequent; there are three or four in this series.

TABLE 3.—RESULTS OF TREATMENT IN THIRTY-EIGHT CASES

Condition	Before Treatment	After Treatment*
Useless	26	6†
Working part time or suffering	11	8
Working full time	1	22

* Two died.

† Two, optic atrophy; two, paretics (hopeless); one, paraplegia (improving); one, cystic glioma (dead).

Usually associated with the increasing specific debility in work, as just described, there is a general nervous state, perhaps best called neurasthenia. The patients are anxious, apprehensive and often say "they are just nervous all the time." As they have become aware of their specific inability to work at a time when this general nervousness is at its height, it is extremely difficult to restore confidence in returning specialized powers. Their nervousness occupies their entire attention, so that they put off by every possible excuse the day of returning to their special occupations. Clearing up the syphilitic process brings back the lost powers of concentration and decision, but the neurasthenic habit of postponement of mental effort must be broken by other means. Encouragement, reeducation and mental and physical calisthenics are the main forces in the hands of the physician. But more important perhaps than all is to require the patient to do some work, no matter what, during the period of treatment. The intervals during the injections are long, and for the patient conducive of introspection. Many patients can go back to work on part time. Usually a word to the employer or to the office force makes this easy of accomplishment. Four such patients have been able to go back effectively to their work. One of these has since died of cerebral hemorrhage.

The true paretic, whatever that be, is apparently not helped by the treatment. Two of the four patients, however, when first seen were classical pictures of paresis. If this condition is not true paresis, the difference must be one of degree, and perhaps the only

way to differentiate them is by their response to treatment. One case of this type tends to relapse when untreated for three or four months, as though it occupied a middle position between the cases which clear up rapidly and the unimproved hopeless cases.

The locomotor ataxia group become useless in their business, either through pain or inability to walk. Either of these is a much more definite and obvious cause than the others have described.

Degrees of pain which are incapacitating are different with each individual, so that some patients are able and willing to go back to work sooner than others. Ataxia patients in whom the ataxia is of long standing improve less than when the onset is sudden, as a rule. The skill and assiduity with which a patient practices

TABLE 4.—DURATION AND AMOUNT OF TREATMENT

Case	Months	Intra-venous	Intra-spinal	Working Capacity		Bio-logic Tests	Shock, Intra-venous	Pain, Intra-spinal
				Before	After			
14	20	14	9	0	W	C—	0	+
49	4	10	0	W	W	C—	+	0
211	2½	6	0	0	0	C—	+	0
126	16	9	9	P	W	C—	0	+
17	6	18	9	0	P	C—	0	+
103	9	29	2	0	W	C—	+	+
128	5½	14	5	P	P*	C—	0	+
93	15	33	8	0	W	C—	+	+
94	13	22	4	0	W	C—	+	+
89	9	21	11	0	P*	C—	+	+
21	2	5	2	0	0	+	+	+
165	9	24	0	0	W	C—	+	0
151	7	28	13	P	W	C—	0	+
76	17	44	8	0	W	C—	0	+
95	18	41	7	0	W	C—	+	+
96	9	19	7	0	0	C—	0	0†
124	17	21	8	0	W	C—	0	+
208	3	10	2	P	W	C—	+	+
140	4	17	8	0	W	C—	0	+
183	5	23	10	P	W	C—	0	+
91	13	19	3	P	W	C—	+	0
90	16	31	19	0	P	C—	+	+
26	10	34	10	0	0	C—	0	+
44	3	7	7	0	0	+	0	+
22	19	39	19	P	W	C—	+	0
173	7	17	6	0	P	C—	+	+
168	6	20	8	P	W	C—	+	+
16	19	33	0	P	W	C—	0	0
179	2	6	3	P	W	C—	0	+
153	6	25	13	0	P	C—	+	+
18	12	16	14	0	W	C—	+	+
12	21	62	24	0	P	C—	+	0
25	28	49	18	0	W	C—	+	0
129	2½	7	7	0	0	C—	+	0
24	26	77	41	0	0*	C—	+	+
102	27	48	38	0	W	C—	0	+
66	10	22	11	0	P*	C—	+	0
201	7	20	10	0	0	+	0	0

* Died.

† Severe spinal shock with coma; no pain at any other injection.

‡ Since going to press this patient suddenly became ineffective at his work and has rapidly deteriorated in the course of two or three weeks into a condition of advanced, bedridden general paresis.

W, full-time work; P, part-time work; C—, all tests clear; C—, all tests almost clear.

his exercises is a distinct factor in determining how soon and to what extent he can return to his work. The self-consciousness and embarrassment of the tabetic also is often a very potent cause of his failure to return to his occupation.

In Table 4 is set forth a complete statement of the length of time and the amount of treatment these cases have received. In parallel columns are indicated the treatment distress and result. It is clear that improvement bears direct relation to the length and intensity of the treatment. When much treatment has been given without the usual improvement there is some other obstructive factor (as optic atrophy, morphinism, or glioma).

SUMMARY

The purpose of the paper has been to show the number and severity of undesirable reactions to treatment, on the one hand, and the results in terms of working capacity, on the other.

The severest reaction to intravenous injections is of the anaphylactic type. The most frequent reaction to the intraspinal injections is pain. The severest is an aseptic meningitis, which may be anaphylactic in origin.

Twenty-six patients out of a total of thirty-eight were economically useless before treatment. After treatment twenty-two were back on full-time work. Rapidity and degree of improvement depend directly on the intensity of treatment. It is important to keep patients at work during the months of treatment.

116 East Sixty-Third Street.

INTRASPINAL ADMINISTRATION OF MERCURIALIZED SERUM

IN THE TREATMENT OF SYPHILIS OF THE
NERVOUS SYSTEM *

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The object of this paper is to call attention to some of the work which we are doing in neurology at the City Hospital; it is not an effort to introduce a new therapeutic measure or disparage an old one. Rather, it is a record of work done. The war has made salvarsan so difficult to obtain, and its price so prohibitive, that we have been obliged to seek other means in the treatment of syphilis of the nervous system. Accordingly, last summer we tried the intraspinal administration of mercury. This paper is a recital of the treatment, and a record of the results. Such a paper can be, to my way of thinking, only in the nature of a preliminary report, for several years must elapse, and hundreds of cases must be treated and observed, before conclusions can be reached that are definite and of value. A great deal of credit for this work is due Dr. Blake F. Donaldson, who at the time was my house physician at the City Hospital, and who carried out the details and the technic.

Irrigation of the spinal canal with 1:30,000 mercuric chlorid solution has already been practiced as a postoperative measure. Ravaut, in 1913, in one of the Paris journals, reported the injection of mercurial salts into the dural space for cerebrospinal syphilis, and only a year and a half ago, Byrnes of Johns Hopkins reported the results of thirty-two cases of cerebrospinal syphilis treated by the intradural administration of mercurialized serum.

The cases which I report are forty-five in number. The patients were all treated in my service in the wards of the City Hospital on Blackwell's Island. Forty were given intraspinal injections of mercuric chlorid, and five were given sublamina injections, so that in all there were given 100 injections of mercuric chlorid and thirty-three injections of sublamina (ethylendiamin-mercury sulphate). These patients at the same time were given every week intramuscular injections of mercuric salicylate, and in the very early ones intravenous injections of salvarsan.

The cases treated comprised cases of tabes, general paresis, cerebrospinal syphilis, taboparesis, clinical tabes (that is, tabes with a negative serology) and syphilitic hemiplegia.

The treatment was given in all except five cases as follows:

About 50 c.c. of blood were obtained readily from the patient's arm with a needle of large caliber, and collected in a sterile cylinder, *preferably*, four hours after an intravenous injection of salvarsan. The blood was slanted, the clot separated, and then left over night in the ice-box. The next morning a sterile centrifuge tube (containing about 13 c.c.) was readily filled with clear serum, and was then centrifuged for five minutes. A few red blood cells were collected at the bottom of the tube, and the supernatant fluid poured (sterilely) into a sterile, freshly washed cylinder. To this one-fiftieth grain of mercuric chlorid was added. It was prepared as follows:

One gm. of Merck's mercuric chlorid was weighed out carefully, and added to a liter of sterile distilled water, which was then brought to the boiling point (when the mercuric chlorid would completely dissolve). Of this solution, 1.3 c.c. contains approximately one-fiftieth grain of mercuric chlorid.

The mixture was then added up to 30 c.c. with sterile saline, and inactivated for half an hour at 58 C. It was then injected within an hour. The injection was given with the patient lying on his side. A 30-c.c. syringe was used, and the fluid run in practically by gravity alone. The foot of the bed was elevated for one hour after the injection, and phenacetin was used liberally for pain.

In the other five cases mentioned above, the mercuric chlorid solution was mixed directly with about 20 c.c. of spinal fluid, and the whole immediately injected. In three of these cases the reaction seemed more severe than usual; the cell count was in two cases increased markedly after two weeks. This technic, though much easier, does not seem in the exceedingly limited number of cases to be as good as the other.

The ten patients with general paresis treated showed less improvement than almost any of the others. One half of them, five, showed no change; two became worse. In only three cases was there any marked improvement. These three patients evinced increased strength and diminished tremor. In none were there any reflex changes, but in four of the ten both the cell count and the globulin were diminished.

Of the eighteen patients with typical tabes dorsalis, only four showed no improvement. The remaining fourteen in every instance were helped. One patient showed marked improvement in his general condition, but little change in his reflexes. Nine showed marked subjective improvement with complete freedom from pain. Two of these eighteen died, but as they were moribund when admitted and were treated really as a last resort, it is not fair to record them in the judgments of this form of treatment. So far as serology was concerned, in these eighteen cases, eight, that is, almost 50 per cent., showed a distinct reduction in both globulin and cell count. The improvement in these cases was one in which there was evidence of gain in weight and in strength, a cessation of pain, a regaining of bladder control, and an improvement in the spinal fluid content.

There were three cases of cerebrospinal syphilis. One patient showed no improvement whatever, the remaining two showed marked reduction in the cell count, and one, a Chinaman, gave very marked evidences of both objective and subjective improvement. At the beginning of the treatment, he was bedridden, greatly emaciated, incontinent, and apparently dying. His mental condition was one of confusion and dementia. From the very beginning he began to improve, holding his improvement, and steadily and persistently adding to it so that at the end of two months he was up and working in the ward.

* Read before the Section on Medicine, New York Academy of Medicine, Nov. 16, 1915.