THE SIGNIFICANCE AND VALUE OF THE LANGE GOLDSOL REACTION IN DISSEMINATED SCLEROSIS.*

By

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RECENT work on disseminated sclerosis, with reports of the finding of a possible etiological factor, on which was based a tentative therapy¹², stimulated my interest in the problem of the clinical course of that disease, and in the changes found in the cerebrospinal fluid, whether occurring spontaneously or following therapy. Lately I had often noticed the frequency of normal colloidal gold curves in the spinal fluid of acute disseminated sclerosis cases, and wondered if the curves were keeping pace with the changing symptom-complex of the disease. As the Charcot symptom-triad had been largely displaced, was it possible that the former 'paretic' typical curve of disseminated sclerosis was to follow suit? Dr. Kinnier Wilson remarked at a medical meeting some years ago that the average colloidal gold curve of disseminated sclerosis seemed to be undergoing changes. At his instigation I undertook to study a group of cases from both the clinical and the laboratory point of view in order to ascertain the present status of the laboratory findings in relation to the clinical course. This work seemed to be indicated in view of the fact that there had lately been published reports¹² which seemed to conflict with those of less recent workers.

This study has been carried on in Dr. Kinnier Wilson's clinic at the National Hospital, and also in his service at King's College Hospital during the course of nine months. Through his courtesy and under his helpful direction, and also with the permission of the Honorary Visiting Staff at both Hospitals, I was enabled to examine more than seventy cases of clinically proven disseminated sclerosis. Each was studied from the clinical and laboratory point of view. Repeated examinations were made and the cases carefully followed up. Any in which there was the least doubt of the diagnosis clinically was not included. Any that had ever had a record of a

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positive blood or cerebrospinal fluid Wassermann reaction was of course excluded, as were those in which the onset occurred late in life.

No selection was attempted; the cases were taken in the order in which they were admitted to Dr. Wilson's clinic and to the services of the other physicians at the National Hospital. The idea was to study the usual run of cases admitted to any large neurological service, but to exclude rigidly from the series any case to which exception could be taken. For this reason many were rejected, and I feel sure that this report is based on the most generally accepted diagnostic evidence. As a preliminary, a resumé of the literature on this subject will be given.

REVIEW OF THE LITERATURE.

Since Lange in 1912 introduced his work on colloidal gold based on Zgismondy's work, we find that in the early years no special interest was taken in disseminated sclerosis cases. The prime interest was, and unfortunately still is, with syphilitic cases, and in the literature the number of undoubted clinical cases of disseminated sclerosis with Lange colloidal goldsol curves is therefore very small.

There has apparently been a kind of 'wave,' or rather two 'waves,' in this respect. At first only occasional cases showed a 'paretic' curve; then as the years went on they all, or nearly all, showed 'paretic' curves (except those published by Kaplan in 1915). Then the wave receded. Fewer 'paretic' curves were found and the 'luetie' curve came into prominence; and at present most authors feel that that also is receding and a curve more nearly approaching the normal is the common one.

The first workers to report on disseminated sclerosis cases with goldsol results were Jaeger and Goldstein in 1913; unfortunately they do not mention the exact number of their cases. They stated that there were slight but definite changes in the first tubes, and called this the 'curve of disseminated sclerosis.'

De Crinis and Eberhard Frank in 1914 reported on four cases with the predominant changes in the first tubes, but concluded that more study is necessary to differentiate between disseminated sclerosis and lues, and also that a larger group of cases is needed.

Flesch in 1914 reported on eight cases—seven giving positive curves and one normal; of the seven positive, six were strongly so, and one weakly positive; and of these six strongly positive cases, most were clinically subacute in type. He also remarked on the sparse literature on disseminated sclerosis with goldsol curves, and said that the amount of material is too small to allow of anything characteristic of disseminated sclerosis being affirmed. However, he stated that a study of the fluid in disseminated sclerosis is valuable, and that the Wassermann test always serves as a

differential criterion between disseminated sclerosis curves and syphilitic curves.

Eskuchen in 1914 reported three positive gold curves and considered the Lange test will prove of value in differential diagnosis.

Solomon and Koefod in 1914 published three cases—of the three one was ‘strongly positive’ and remained so when retested five months later; one was completely normal, and the third showed slight changes.

Kaplan and McClelland in 1914 recorded two cases—one ‘strongly positive’ and the other with predominant changes in the first tubes.

Neue in 1914, quoting three cases, stated that they showed weak to strong positive goldsol curves but no special characteristics, and the curves are not given.

Kaplan in 1915 reported on 18 cases—one case with changes in the first two tubes of a strong degree and the other 17 normal.

Miller-Brush-Hammers and Felton (1915) published three cases with three paretic curves.

Solomon and Koefod-Welles (1915) mentioned four cases—two yielding paretic curves and two in the syphilitic zone, but no other details are given.

Oetiker (1915) had three cases—two with only a minimal change and one definitely positive in the first three tubes.

Robertson (1916) found in his case that there was no change in the first six tubes, and slight progressive change in the seventh and eighth, while the ninth and tenth were water-clear.

Lowrey (1917) reported one disseminated sclerosis case without detail.

Hammers (1917) recorded four cases—three with normal curves and one strongly positive, and concluded that a paretic curve with other negative spinal fluid findings might be of help in suspected cases.

Eskuchen (1918) alluded to disseminated sclerosis cases without specifying their number, and stated that the gold reaction is frequently a typical luetic one and the mastic always.

Vogel (1918) discussed three cases, but unfortunately one of these had a positive blood and cerebrospinal fluid Wassermann reaction, and in another case the diagnosis was in doubt.

Fehrenfeld (1918) mentioned some disseminated sclerosis cases, stating that none of the non-luetic cases gave strong positive curves.

Bonsman (1920) reported eight cases, finding a luetic light curve. No actual curves were cited in his article.

Moore (1920) remarked that a paretic curve had been appearing since 1912 in conditions other than paresis, such as lead-poisoning, tuberculous meningitis, brain tumour and disseminated sclerosis, and decided, as so little had been written on this point, to survey the entire literature. He concluded that down to 1920 nothing characteristic of disseminated sclerosis has been

found with the goldsol test, owing to the small number of cases reported and lack of uniformity of results, and decided to study the material in his clinic. He summarized the results of the literature to 1920 as follows: 40 cases—14 of these paretic cases, 25 normal, and one atypical. Of 28 cases in his clinic, in which the clinical diagnosis was either certainly or probably disseminated sclerosis, the results were: 18 paretic curves, three syphilitic and seven normal; but of these 28 cases he queried the diagnosis in eight, and among the 20 definite cases he obtained 18 paretic and two normal curves. Of the eight questionable cases five showed normal curves and three syphilitic. He considered that the average of the 28 cases is high enough to exclude the assumption of a merely occasional, accidental, finding of such a curve, i.e., paretic, and this led him to suppose that the eight cases were diagnosed wrongly. In other words, he was so convinced that a paretic curve is the normal, that, failing to find it, he doubted his own clinical diagnosis.

Warwick and Nixon (1920), with 22 cases, reported nine in zone II, two in zone I, and nine normal, and they emphasized the fact that the curve is not typically paretic but rather in the syphilitic zone.

Stern and Poensgen (1920), with 14 cases, reported four completely normal, paretic curve in four, and stressed the point that while some authors always postulate a paretic curve, yet negative curves do occur.

Adams (1921) with 41 cases, said that all save two gave luetic or paretic reactions, and these two cases had been diagnosed as arteriosclerosis simulating disseminated sclerosis. Five of the 39 cases gave paretic, and the others luetic curves; but, unfortunately, of these 39 cases, nine had positive Wassermann reactions. Four of the nine gave positive Wassermann tests in both blood and cerebrospinal fluid; two in the blood only, and two in the fluid only; one case gave a positive reaction in the fluid while the blood was not tested. This worker also stated that the curve had changed in 16 cases under treatment—the paretic curve becoming luetic under neosalvarsan, while in one a completely normal result was ultimately obtained after twelve injections of novarsenobillon and mercury. In practically every case modification occurred in the direction of a normal curve.

Adams again in 1921, with Dunlop and Blacklock, commented on a negative curve in a typical disseminated sclerosis case.

Thompson (1921) obtained five paretic curves in five cases.

Weigeldt (1921) published 14 cases, obtaining 11 positive and three normal curves.

Ayer and Foster (1922) surveyed 38 cases. There were 33 patients and 42 curves, 21 paretic curves in 16 patients, seven syphilitic curves in seven patients, three curves with slight changes in three patients, and 11 normal curves in ten patients. These workers reviewed the literature and attempted to analyse the course of the disease to find out if the Lange curve is of any

value in this connexion. They concluded that while superficially there seems to be a parallel between activity of the disease and pathological findings in the fluid, yet the analysis of two cases (their cases 11 and 35) showed in each a change under observation in the Lange curve without any alteration in the clinical course. They argued that a change in the Lange curve is not always synchronous with a clinical change and suggested that a larger series should be investigated to see whether the spinal fluid examinations are often as variable as indicated by these two special cases.

Worster-Drought, Fry and Lynch in 1922 analysed 15 cases—18 gave positive curves (of these, 12 were luetic and one was a paretic curve) and two gave normal curves; the two latter were old quiescent cases. They concluded that disseminated sclerosis is associated with positive curves, the type of which varies with the intensity and the stage of the disease.

Eskuchen (1922) recapitulated the literature, stating that the material was too small to be of statistical value up to the time of writing, with the exception of that of Adams and Moore. Adams with his 41 cases included seven with positive Wassermann reactions, and therefore these seven were certainly not clear-cut disseminated sclerosis cases, which invalidated his results; as for Moore's 28 cases, eight were not verified. Eskuchen then added 41 cases of his own which he considered genuine, and his conclusions were that 31, or 75.6 per cent., showed changes in the fluid and yielded typically strong syphilitic reactions. He did not agree with Ayer and Foster that paretic curves occur in acute cases—he thought it more likely in old cases. Ten cases, or 24 per cent., were normal or showed slight change.

The paper of Fredja and Taussig (1922) was unfortunately not available personally; these authors are quoted by Sternberg as having obtained positive goldsol curves in from 50 to 70 per cent.

Pisani (1923) in six cases obtained six positive curves.

Wright and Kermak (1923), with seven cases, reported four normal and three positive.

Flockenhaus and Tonseca (1924) had two cases with two paretic curves.

The 67 cases of Wexberg (1923) gave 19.9 per cent. paretic and 24.6 per cent. luetic curves.

Müller in 1925 (100 cases) continued the work of Ayer and Foster, trying to find a synchronous change as between clinical course and Lange curves, and while a general tendency of the kind could be traced, he also found normal fluids in acute cases.

Conoway and Hill, in 1927, with ten cases of disseminated sclerosis where the diagnosis was confirmed by autopsy findings, reported the Lange curves to be two paretic, three luetic and five normal.

Sternberg in 1928 gave an excellent review of all previous work done on the spinal fluid in the disease and added 83 cases of his own; he found 25

per cent. of the cases normal, and changes in 75 per cent. The predominant alterations affected the syphilitic rather than the paretic zone. Following Ayer and Foster and Müller, he also tried to find a connexion between the clinical course and the Lange curve, but concluded that none of a regular and definite kind could be determined.

Potts and Drake in 1928, with 35 cases, reported eleven in the paretic or zone I, four in the luetic or zone II, ten indefinite and ten normal. Of these 35 cases, ten were confirmed by autopsy, and of these ten, the curves in six were positive, one weakly positive, and three were normal; and in one case (their case 3) the curve varied on several occasions.

McIntyre in 1929 reported five cases with five paretic curves.

Purves Stewart (1930) described a few cases and their changing curves under a special therapy based on the alleged discovery of the *spherula insularis*.

McDiarmid (1931) mentioned five cases—one normal, two weakly positive and two strongly positive.

The above abstract of the literature is based entirely on the reports of workers who presented their own cases of disseminated sclerosis with coincident Lange curves. Many other workers have summarized this literature and given cases of their own without, however, including colloidal gold results. These papers are therefore not utilised in this study. The results of those who worked mainly with the other colloids are also ignored. I have also worked with the other colloids but for comparative purposes only; the reporters on Lange gold colloids have been referred to above, for the sufficient reason that the tentative therapy applied in connexion with the alleged recent discoveries⁴² has been worked out on a basis of the Lange colloidal gold reaction only.

In a separate category, however, is the work of Greenfield and Carmichael³⁶. They analysed the case-histories of 190 patients whose spinal fluids had been examined by Greenfield in the laboratory at Queen Square. It is to be noted that they rigorously excluded any cases that might have been considered doubtful on the ground of late onset, or of positive blood or spinal fluid Wassermann test. They reported 14 per cent. paretic curves, 19.5 per cent. luetic curves, 6.8 per cent. completely normal curves; 59.5 per cent., or two-thirds of all cases, gave curves which did not pass a blue colour.

Further, in 1928 Greenfield declared 'as a normal picture for disseminated sclerosis the Lange to be either 5544321000 or 0012321000 or completely normal.'

In 1931 a report by Carmichael during the course of this study confirmed his previous work with Greenfield by stating that the colloidal gold curves in disseminated sclerosis vary from normal to paretic in acute as well as chronic cases.

TABLE I.
SUMMARY OF CASES FROM THE LITERATURE.

Author.	Year.	No. of Cases reported.	Gold Curves.	Conclusions of Author.
Jaeger and Goldstein	1913	?	Slight changes in first tubes	Typical curve of disseminated sclerosis is a change in the first few tubes
De Crinis and Eberhard Frank	1914	4	Predominant change in first tubes	More study is necessary and larger group of cases needed
Flesch	1914	8	7 positive, 6 strongly positive; 1 weakly positive; 1 normal	Of the 6 strongly positive cases clinically most were subacute; literature too sparse; amount of material too small for anything characteristic of disseminated sclerosis
Eskuchen	1914	3	3 positive	Believes the Lange test will prove of value
Solomon and Koefod	1914	3	1 normal; 1 slight changes; 1 strongly positive	
Kaplan and McClellan	1914	2	1 predominant change in first tube; 1 strongly positive	
Neue	1914	3	Weak to strongly positive curves	No special characteristics shown by these fluids
Kaplan	1915	18	17 normal; 1 strong change in first 2 tubes	
Miller-Brush-Hammers-Felton	1915	3	3 paretic curves	
Solomon-Koefod-Welles	1915	4	2 syphilitic zone; 2 paretic zone	
Oetiker	1915	3	2 minimal change; 1 positive in first 3 tubes	
Robertson	1916	1	Slight change in 7th and 8th tube	
Lowrey	1917	1	No details given	
Hammers	1917	4	3 normal; 1 strongly positive	A paretic curve with other normal spinal fluid findings might be of help in suspected disseminated sclerosis cases

Author.	Year.	No. of Cases reported.	Gold Curves.	Conclusions of Author.
Eskuchen	1918	?	Frequently typical luetic	
Vogel	1918	3	1 positive blood and cerebrospinal Wassermann; 1 case clinical diagnosis doubtful	
Fehrenfeld	1918	?		None of the non-luetic cases gave strong positive curves
Bonsman	1920	8	Luetic-like curve	
Moore ¹	1920	28	7 normal; 3 syphilitic	Queries the clinical diagnosis when the curve is normal
Warwick and Nixon	1920	20	2 in zone I (paretic); 9 in zone II (luetic)	The typical curve is not paretic but in the syphilitic zone
Stern and Poensgen	1920	14	4 normal; 4 paretic	While many authors postulate paretic curves yet normal curves do occur
Adams ²	1921	41	39 luetic or paretic; 2 normal	The 2 normal cases had been diagnosed as arteriosclerosis simulating disseminated sclerosis
Adams	1921	1	Normal curve	Says this is a typical disseminated sclerosis case
Thompson	1921	5	5 paretic curves	
Weigeldt	1921	14	11 positive curves; 3 normal curves	
Ayer and Foster ...	1922	38 (33 patients and 42 curves)	11 normal curves in 10 patients 3 positive " " 3 " 7 syphilitic " " 7 " 21 paretic " " 16 "	
Worster-Drought, Fry and Lynch	1922	15	2 normal; 12 luetic; 1 paretic	Disseminated sclerosis is associated with positive curve
Eskuchen	1922	41	10 normal or slight change; 31 typical slight syphilitic	Material too small for statistical value up-to-date
Fredja and Taussig	1922	...	50 to 70 per cent. positive curves	

Author.	Year.	No. of Cases reported.	Gold Curves.	Conclusions of Author.
Pisani	1923	6	6 positive curves	
Wright and Kermak	1923	7	4 normal; 3 positive	
Flockenhaus and Tonseca	1924	2	2 paretic curves	
Wexberg	1925	67	24.6 per cent. luetic curve; 19.9 per cent. paretic curve	
Müller	1925	100		Finds normal fluids in acute cases, though there is a trend for acute cases to show stronger curves
Conoway and Hill ...	1927	10 /	5 normal; 3 luetic; 2 paretic	These cases all verified autopsy
Sternberg	1928	83	25 per cent. normal; 75 per cent. show changes predominant in syphilitic zone	
Potts and Drake ...	1928	35	10 normal; 10 indefinite; 4 luetic zone II; 11 paretic zone I	10 confirmed at autopsy positive; of these 3 normal, 6 positive and 1 weak positive and 1 varied
McDiarmid	1931	5	1 normal; 2 weakly positive; 2 strongly positive	

1. Moore queries his clinical diagnosis when the Lange curve is normal, but Conoway and Hill in 1927, and Potts and Drake in 1928 have obtained normal curves in clinically diagnosed disseminated sclerosis cases, and later confirmed their diagnosis by autopsy. Conoway and Hill had five normal Langes in ten cases, and Potts and Drake had ten normal Langes in 35 cases.

2. Of Adams' 39 cases, nine gave positive Wassermann tests in blood or spinal fluid or both.

3. The general understanding among the above writers is that a normal curve shows all zeros or practically all zeros, i.e. 0000000000 in dilutions 1/10 to 1/5120, or occasionally 0010000000, or 0000100000, or 0100000000.

A 'paretic' or zone I curve shows the maximum precipitation in the first five tubes; for instance, 5543210000, or 4433220000, or 1233000000, i.e. dilutions 1/10 to 1/160.

A 'luetic' or zone II curve shows the maximum precipitation in the middle zone, or the third to seventh tube, i.e. dilutions 1/80 to 1/640.

A positive curve is given by any fluid other than a normal, i.e. by any fluid showing precipitation to any degree.

A weakly positive curve shows precipitation definitely but slightly in any dilution, irrespective of grouping.

A strong positive curve shows strong precipitation of the colloidal gold in any dilution.

DISCUSSION.

Summarizing the results of all workers from 1912 to 1930 we note that the general findings of all those who dealt with a sufficient number of cases are so similar as to be of definite value.

Eskuchen, Wexberg, Müller, Sternberg, and, with two exceptions, all other observers agree that the Lange curve has changed from the former typical 'paretic' curve to that of a 'syphilitic' or zone II curve, and that normal curves occur in as high a percentage as 25 per cent. of all cases studied. The only two exceptions are Adams and Moore; Adams unfortunately included in his series cases with positive blood or spinal fluid Wassermann reactions, and we must agree with Eskuchen that 'certainly the clinical verification of Adams' cases can legitimately be questioned.' Moore doubts his own clinical diagnosis when eight of his cases showed normal curves, but in view of the evidence presented by Conoway and Hill and by Potts and Drake we can no longer doubt that normal curves do occur in disseminated sclerosis, since they have proved this by following their cases to autopsy.

All these workers seem to be in agreement on another important point. Since the studies of Ayer and Foster in 1922, all have tried to find a parallel between the course of the disease and the changes in the spinal fluid. Again all agree that there is no accurate parallelism. True, there seems to be a tendency for acute cases to show stronger spinal fluid changes, but there are so many exceptions to this rule that no observer will admit anything more definite than that there is a trend toward this relationship. Ayer and Foster, also Müller and Sternberg, analyse individual cases which definitely refute the contention.

Still more important is the effect of therapy on the changes in the spinal fluid. All observers again agree that the fluid changes spontaneously and under various forms of treatment, either with or without coincident clinical change.

In 1930, however, a group of workers⁴² reporting on a new method of therapy suggest that its success is indicated by disappearance of the spinal fluid changes; they claim that all their cases show initial alterations in the fluid, and that these disappear or tend to disappear following specific therapy.

PERSONAL RESEARCHES.

As these results seemed to contradict all previous reports up to 1930 we instituted this study in Dr. Wilson's clinic to see if the findings of the group

of workers from 1912 to 1930 still held good, or if spinal fluid readings were consistent enough to be used as an indication of the success or failure of therapy, as the new work seemed to indicate.

Our conclusions are as follows:—

- I. Of 70 cases we find 25 per cent. show completely normal Lange colloidal goldsol curves; 25 per cent. show paretic curves, and 50 per cent. show almost every possible intermediary curve between the normal and paretic zones.
- II. We find no definite parallel between the clinical course and the spinal fluid findings. Often a normal curve occurs in an acute case as well as a strong curve in an old stationary case, and vice versa.
- III. We find that the fluid alters both spontaneously and following treatment of all kinds—with or without a corresponding clinical modification.
- IV. Our results confirm the conclusions of all those from 1912 to 1930 who have worked with a large number of cases.

With the exception of the recent reports of 1930 the consensus of opinion seems to be that the Lange goldsol test, while of distinct interest, is not sufficiently definite to be used as an indication of the success of therapy.

In a disease that has spontaneous remissions we must be very guarded as to the value of any therapy, and if we wish to use the goldsol test to help in gauging the results of treatment we must first establish what the normal curve is in any case of disseminated sclerosis.

Up to the present we feel that no one has shown that any real value can be placed on colloidal gold curves in disseminated cases.

We have noted that 25 per cent. of all cases in any stage of the disease show perfectly normal gold curves. We have also noted that the curve is liable to change with or without treatment, and we have the results of autopsied cases to verify these statements.

If the Lange curve is ever to be used in disseminated sclerosis as a basis or guide for therapy we feel that sufficient research should first be conducted to find out what constitutes the exact normal for a case of disseminated sclerosis. We would suggest that each case must be studied over a period of years through the various stages of remission and exacerbation; that the patient should be submitted to lumbar punctures at regular intervals in the acute and chronic stages; that one series of cases should remain untreated, and a second series be treated with the usual arsenical preparations and a third with a more specific therapy if there be one. Then we will have a sufficiently large series of cases properly controlled and studied through the periods of remission and exacerbation to judge if the Lange test is to prove of value in the study of the disease. The largest series of cases ever studied in the twenty years since this test has been used is Müller's (100 cases), and

when we compare this with the thousands of cases of syphilis published with coincident Lange curves, we realize that the value of the test in disseminated sclerosis still remains to be proved.

All laboratory work was done under Dr. Greenfield's direction at the National Hospital, or in the laboratories at King's College Hospital. The reliability of the method when carried out in one laboratory with one technique and with such a vast amount of control material as offered daily at the National Hospital, cannot be called in question. For the privilege of examining and using a number of cases I am indebted to the staffs of the National Hospital, Queen Square and of King's College Hospital.

TABLE II.—PERSONAL CASES.

No. Sex.	Age.	Duration.	Clinical Type.	Lange Curve.	Remarks.
1 F	56	35 years	Multiple	3343321000	Confirmed by autopsy
2 F	35	1 year	Hemiplegic	0111000000	
3 M	35	2 years	Spastic-ataxic	1121211000	
4 M	33	4 years	Multiple	0001101000	
5 F	32	2 years	Spastic paraplegia ...	0111000000	
6 F	26	6 months	Amaurotic, sensory ...	0123211000	
7 F	33	1 year	Spastic-ataxic	0012211000	
8 F	56	34 years	Spastic paraplegia ...	0000000000	
9 M	51	36 years	Multiple	0000000000	
10 M	26	6 months	Amaurotic, paraplegic	1122212100	Marked improve- ment after hyst- erectomy
11 M	26	7 years	Multiple	0011222100	
12 F	36	6 years	Hemiplegic, paraplegic	3445443211	
13 M	23	2 months	Ataxic, cerebellar ...	0001222110	
14 F	27	10 months	Amaurotic, paraplegic	1234322000	
15 F	45	18 years	Paraplegic	0001121000	
16 M	44	7 years	Diplopia, paraplegia ...	0000000000	
17 M	34	8 years	Spastic-ataxic	4544443210	
18 F	40	4 years	Hemiplegic	0000000000	
19 M	27	4 years	Cerebellar, paraplegic	0001222100	
20 M	35	5 years	Spastic-ataxic	4545542111	
21 F	42	1 year	Amaurotic, paraplegic	0000000000	
22 F	44	22 years	Amaurotic, paraplegic	0122210000	
23 F	25	5 years	Quadriplegic	4433333100	
24 M	28	5 years	Diplopia, paraplegia ...	0000100000	
25 F	46	31 years	Multiple	3433321000	
26 M	46	2 years	Spastic paraplegia ...	0001100000	
27 M	42	4 years	Sensory, spastic ...	1121211000	
28 F	44	29 years	Amaurotic, paraplegic	5554321100	
29 F	31	11 years	Amaurotic, paraplegic	1112100000	
30 F	51	25 years	Amaurotic, paraplegic	0121100000	
31 F	36	19 years	Quadriplegic	0011100000	
32 F	40	4 years	Pontine, paraplegic ...	0011220000	

No.	Sex.	Age.	Duration.	Clinical Type.	Lange Curve	Remarks.
33	F	29	10 months	Cerebellar, sensory ...	4554431000	0000000000 a month later
34	M	23	2 years	Amaurotic, sensory ...	0001110000	
35	F	45	5 years	Quadriplegic	5555421000	
36	M	47	27 years	Multiple	5555343210	
37	F	46	16 years	Quadriplegic	0070111000	Recurrences after each of three parturitions
38	F	38	1 year	Pontobulbar, ataxic ...	1122121000	
39	M	25	7 months	Spastic-ataxic	1223323210	
40	F	44	25 years	Paraplegic	0112222100	
41	M	25	2 years	Spastic-ataxic	0001110000	
42	F	38	10 years	Quadriplegic, ataxic ...	5555544321	
43	F	43	8 years	Spastic-ataxic	4233322000	
44	F	40	22 years	Amaurotic, spastic-ataxic	5555503321	
45	F	21	6 years	Amaurotic, hemiplegic	0011000000	0000000000 two years previously
46	M	53	9 years	Spastic-ataxic	2333322110	
47	M	46	8 years	Sensory, paraplegic ...	2122211100	0110000000 a year before
48	F	29	2 years	Pontine, paraplegic ...	4433432100	
49	M	40	4 years	Spastic-ataxic	0011110000	
50	F	41	7 years	Ataxic, paraplegic ...	0111000300	5454331100 five years before
51	F	31	5 years	Ataxic, paraplegic ...	5555542100	
52	F	43	2 years	Spastic paraplegia ...	0000000000	0000000000
53	M	48	6 years	Sensory, spastic paraplegia	0000000000	
54	M	11	1 year	Multiple	0011110000	0000000000
55	F	20	3 months	Diplopia, paraplegia ...	0001110000	
56	F	19	1 year	Diplopia, paraplegia ...	0000000000	1111000000
57	M	42	8 years	Sensory, ataxia	1111000000	
58	F	33	4 months	Ataxic, paraplegic ...	2110000000	1112221000
59	M	20	1½ years	Hemiplegic, paraplegic	1112221000	
60	F	44	24 years	Sensory, paraplegic ...	3322210000	0011233444
61	F	49	10 years	Multiple	0011233444	
62	M	29	4 years	Paraplegic	0000000000	0000000000
63	M	41	2 years	Paraplegic	0000000000	
64	M	21	2 weeks	Sensory, paraplegic ...	0000000000	5542210000
65	F	39	4 years	Sensory, paraplegic ...	5542210000	

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