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OBSERVATIONS ON POLYRADICULO-NEUROPATHY (LANDRY-GUILLAIN -BARRE-STROHL SYNDROME) IN CHILDREN*

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Polyradiculo-neuropathy or the Landry-Guillain-Barré-Strohl syndrome appears to be an established clinical entity characterised by symmetrical loss or diminution of muscle power, hypotonia, loss of deep reflexes, some sensory impairment and occasional involvement of cranial nerves, particularly the facial nerve. The cerebrospinal fluid (C.S.F.) shows a characteristic change, a rise in protein content with no increase of cells, 'la dissociation albumino-cytologique'.

There is still some confusion about the nomenclature and different terminologies are in use for the condition such as Landry's paralysis, acute febrile polyneuritis, infectious neuronitis, acute toxic polyneuritis, Guillain-Barré syndrome, polyradiculoneuritis, acute idiopathic polyneuritis, Landry-Guillain-Barré syndrom e etc. Landry (1959) reported a fatal case of acute ascending paralysis. The paralysis commenced in the distal part of the lower limbs and rapidly spread upwards with involvement of upper limbs, trunk, respiratory muscles and cranial nerves. Death was ascribed to respiratory failure. The paralysis was of the flaccid type with loss of deep reflexes but there was no sensory disturbance. Autopsy failed to detect any definite morbid changes in the spinal cord. A very good clinical description of 'acute febrile polyneuritis' could be found in the first edition of William Osler's "Principles and Practice of Medicine" (1892). It seems that very little could be added to the clinical description since then. Guillain, Barré and Strohl (1916) added the cerebrospinal fluid findings. In the recent past there has been a growing tendency to consider Landry's paralysis and Guillain-Barré syndrome as one entity and not to attempt any hair-splitting distinction between the two. The question of correct terminology for the entity has been discussed by Haymaker and Kernohan (1949), Weiderholt *et al.* (1964) and Leneman (1966). In view of the immunological studies in the condition (Waksman and Adams 1955, Campbell 1957, Melnick 1963), the descriptive term 'polyradiculo-neuropathy' has been preferred in this communication. As Strohl was a co-author in the original contribution by Guillain and Barré, his name has also been associated with the syndrome as a token of appreciation as

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has been suggested by Weiderholt *et al* (1964).

Materials and Methods

This study has been carried out at the B.C. Roy Polio Clinic and Hospital for Crippled Children, Calcutta. It was initiated in 1967 and is still being pursued. One hundred and twenty cases of polyradiculo-neuropathy (Landry-Guillain-Barré-Strohl syndrome) form the subject matter of the present study. The patients were selected on the basis of symmetrical paralysis or paresis of all four limbs with or without sensory impairment, albuminocytologic dissocia- in the cerebro-spinal fluid and follow up studies. Only those patients whose C.S.F. protein content was raised to 60 mg. per cent or higher with the cell count remaining normal (0-5 cells/c.mm) were included in this study. Muscle power assessment was done in all the cases according to the method advocated by the Medical Research Council (1943) when the initial or the spreading phase was over. Lumbar puncture could be repeated in 86 patients, 5 times in one patient. The interval between the two lumbar punctures was one month.

All the cases in the present series have been followed up for at least 3 months. The maximum period through which a case could be followed up was over 4 years. A patient was declared cured when his muscle power and reflexes became normal.

The therapeutic schedule followed in this series included complete rest in bed in the early phase and symptomatic relief of pain by aspirin, paracetanol, warm compresses. The limbs were supported in the neutral position, foot-drop was prevented by aluminium or polythene ankle supports, knees and hips were kept straight and shoulders were supported in abduction by pillows or sand bags. These positions were changed several times in a day. All the patients received vitamins—specially vitamin B_{12} or preparations containing vitamin B_1, B_6 and B_{12} and vitamin C orally. Antibiotics were freely used when there was any suspicion of intercurrent infection. Antihelminthics were used when necessary. A mechanical sucker was used to keep the mouth and airway clear in case of bulbar involvement, in addition to the prone or lateral decubitus. Active physiotherapy was started when the initial or the spreading phase was over.

A course of steroids-predniso-lone in 22 cases, prednisolone followed by anabolic steroids as methandienone or ethyestrenol in 11 cases and anabolic steroids alone in 22 cases were given in addition to routine treatment as stated. Thus the remaining 65 cases received only vitamins. Steroids were used mostly in the initial period of this study. The usual dosage of prednisolone was 15 to 30 mg. daily depending on the age of the child, for the initial two weeks and then gradually tapered off. The total period of administration was about 6 weeks. Prolonged administration was necessary in one case with relapse. Anabolic steroids (methandienone or ethylestrenol) were given in a dose of 0.5 to 1 mg. daily for 4 weeks.

Observations

Age distribution

The age distrribution of the patients in this series is presented in Table 1. All the patients in this series except one were children under 15 years

of age. The youngest patient was aged one year and the oldest 17 years.

It was seen that the highest number of cases—46 (38.3 per cent) belonged to the age group of 3 to under 6 years.

Sex distribution

There were 77 males (64 per cent) and 43 females (35 per cent).

Initial symptoms

The onset of the illness was reported to be insidious in 66 cases and relatively rapid in 54 cases. A history of fever could be elicited in 57 patients (47.5%) out of the 120 cases under study. The duration of the fever is shown in Table 2.

The fever was stated to be mild to moderate by the parents but in most cases it was not verified by thermometer.

The presenting complaint in most of the patients was difficulty or inability

Table 1. *Age distribution of 120 cases of polyradiculo-neuropathy (Landry-Guillain-Barre-Strohl) syndrome.*

Age group (in years)	No. of cases	Percentage
Birth to under 3	28	23.33
3 to under 6	46	38.33
6 to under 9	27	22.50
9 to under 12	11	9.16
12 to under 15	7	5.83
15 and above	1	0.83
	120	100.00

Table 2. *Incidence and duration of fever.*

Duration of fever (in days)	No. of cases	Percentage
1 — 7	46	38.33
8 — 15	2	1.66
15 — 21	9	7.50
No fever	63	52.50

in walking, standing or sitting or weakness of the limbs. In 11 patients there was a history of fall during walking or playing prior to other symptoms. But no obvious injuries were detected in any one as a result of the fall. It was likely that the 'fall' attracted the attention of the parents to the underlying muscular weakness. In 13 patients, limping for a day or two preceded loss of locomotion. Two patients initially complained of a tingling sensation of palms and soles as the initial symptom. One patient complained of headache on the first day and inability to get up from the squatting posture in the toilet on the next day. The weakness went on increasing and within the next seven days, he became completely bedridden. Difficulty in climbing stairs was the initial symptom in one. Unsteadiness of gait was complained ef by 9 patients. Loss of head control was seen in 18 patients—all infants. Pain was complainedof by 62 patients and headache by 6 patients.

Pattern of involvement

History indicated some spread of paralysis in all the patients except seven. The lower limbs were initially affected in 77 patients followed by the upper limbs. In six patients there was weakness of the hands initially followed by weakness of the lower limbs. In six other cases the sequence of events could not be ascertained. In the remaining cases history was suggestive of simultaneous onset of weakness of upper and lower limbs. From the history it was difficult to ascertain involvement of the trunk. There were three phases in the clinical course of the condition—the initial spreading phase, the stationary phase and the third phase of recovery. In most cases the spread and the recovery phases were found to be relatively distinct but the intermediate or the stationary phase was not so. The stationary phase lasted for a few days only. The duration of the spreading phase is shown in Table 3.

Table 3. *Duration of the spreading phase.*

Duration	No. of cases	Percentage
1— 7 days	36	30.00
8—14 days	36	30.00
15—21 days	31	25.83
22—28 days	3	2.50
1 month	11	9.16
Not ascertained	3	2.50

Recovery phase

92 cases have completely recovered so far (Table 4). Six other cases did improve considerably but then stopped attending the clinic before complete recovery. Recovery has been poor in two cases. There has been relapse in 6 cases. The remaining cases are still undergoing recovery and being followed up. Table 4 shows the period of recovery in 92 cases already declared cured.

Thus 55 patients recovered within six months and 80 patients within 1 year.

Relapse or recurrence

As already stated there has been a relapse or recurrence in six cases out of 120 patients in the series. In all of them relapse followed an attack of fever usually associated with cough and cold. In one case there have been three relapses and in this particular case steroids seemed to exert a favourable effect. Four of these six patients were found to have ascariasis as well. Apart from relapse the clinical picture was indistinguishable from others. With relapse the protein content of the C.S.F. also showed a rise.

Sensory disturbances

Pain mostly in limbs and back was complained of by 62 patients and tingling sensation in the feet or hands by 11 patients. Pain was rather diffuse and vague in nature and persisted usually for one to two weeks but the tingling sensation persisted for over a year in one patient. Muscular cramp was complained of by three patients. Objective sensory disturbances such as hypoesthesia of glove and stocking type could be detected in 10 cases.

Cranial nerve involvement

The pace was affected in 21 cases but facial diplegia could be detected in 11 cases. Paralysis of the soft palate, pharynx and larynx was detected in 37 cases. There was ophthalmoplegia in 14 cases.

Table 4. *Period of apparent recovery.*

Time of recovery	No. of cases
1 month-3 months	19
3-6 months	36
6-9 months	18
9-12 months	7
1 year-2 years	8
2-3 years	3
3-4 years	1

Distribution of paralysis

All the patients showed paralysis or paresis of all four limbs with or without involvement of cranial nerves *(vide supra)*. There was also loss of head control due to weakness of the neck muscles in 10 cases, all of them infants. The distal group of muscles in the limbs were more severely affected in 85 cases, the proximal group in 6 and the paralysis was equally distributed in proximal and distal groups in the remaining cases.

Reflexes

The deep reflexes were all lost in the early phase. During recovery, out of 92 cases declared cured so far, in 60 the deep reflexes took a much longer time to return than the muscle power. In them, even after an apparent recovery of muscle power, the reflexes could not be elicited even on reinforcement for a variable period. The ankle jerk was usually the last to return. In 32 patients the muscle power and the deep reflexes became normal almost simultaneously.

Other relevant features

Stiffness of neck was detected in 11 cases and was slight in all except one. In this particular case the stiffness of the neck was fairly marked and the child was admitted to a neighbouring hospital with a suspicion of meningitis but there was no pleocytosis in the C.S.F. Other features also indicated the diagnosis of polyradiculoneuropathy. Mild constipation was fairly common but 12 cases needed laxatives or enemata for their constipation. Two patients suffered from retention of urine which responded to prostigmin orally. Another patient developed retention of urine during the recovery phase. This patient had congenital hypospadias and the retention of urine was due to calculi blocking the urethral opening. The retention was relieved on removal of the calculi. Three patients showed incontinence of urine. In one of them urine examination revealed evidence of urinary tract infection and the incontinence disappeared within a few days of treatment. One patient suffered from incontinence of urine only for a transient period. In the other case, the incontinence persisted for about 3 weeks. There were convulsions in one patient during his stay in the hospital but it subsided after an injection of paraldehyde. This particular patient passed a number of roundworms while in hospital. There was ophthalmoplegia, ataxia and areflexia simulating the Miller-Fisher syndrome in one patient but due to associated symmetrical weakness of the limbs with albumino-cytological dissociation in the C.S.F., he has been included in this series.

Cerebrospinal fluid protein

According to the protein content of the C.S.F. the patients were arbitrarily classified into three groups: (a) Cases with a high concentration of protein i.e., 201 mg. per cent and higher (b) moderately raised protein content — 101 to 200 mg. per cent and (c) a mild rise of protein —60 to 100 mg. per cent. Table 5 shows the distribution of patients in each group.

Barring seven patients, the protein content of the C.S.F. was high on initial examination in all. In two of these cases a further rise could possible be explained by relapse. There were 4 cases in this series whose protein content

Table 5. *Distribution of patients according to the protein content in the cerebro-spinal fluid.*

C.S.F. Protein (mg. %)	No. of cases	Percentage
201 and above	33	27.50
101 to 200	56	46.66
60 to 100	31	25.83

of C.S.F. exceeded 500 mg. per cent. The highest C.S.F. protein content in this series was 620 mg. per cent. This was in a male child aged 4 years who had convulsions after admission and was suffering from ascariasis as well. The C.S.F. protein content came down to 50 mg. per cent on repetition of lumbar puncture about one and a half months after the onset of the illness. There was little or no correlation between C.S.F. protein level and the clinical severity, degree, extent and duration of paralysis.

Associations with a possible etiological cause

In 21 cases, no history of any preceding illness or inoculation could be detected. In the remaining 99 cases history revealed the following factors either alone or in combination prior to the present illness. It may be stated here that in the last 45 cases, some factor or factors could be found in all.

1. Respiratory tract infections (Sore throat, cough and cold) 33 cases
2. Superficial infections (boils, abscesses, ulcerations, etc.) 23 cases
3. Loose stools 8 cases
4. Measles 5 cases
5. Chicken pox 1 case
6. Pertussis 1 case
7. Mumps 1 case
8. Prolonged fever 2 cases
9. Urinary tract infections 1 case
10. *Vaccinations*
    - (i) Combined diphtheria, tetanus and pertussis prophylactic 3 cases
    - (ii) Rabies vaccine 3 cases
    - (iii) Smallpox vaccine 2 cases
    - (iv) Oral polio vaccine 2 cases

It may be stated here that 40 patients in this series were found to be suffering from ascariasis, 15 from giardiasis, 3 from hookworm and 1 from *Trichuris trichura* infection. It may further be stated here that in the last 45 cases, 23 cases (51.11 per cent) were found to be suffering from ascariasis as well.

Therapeutic schedules

From the clinical response, it was difficult to draw any conclusion regarding the superiority of any schedule over the others in the dosage used. However,

steroids seemed to exert a beneficial effect in one patient who had 3 relapses.

Discussion

In view of the existing differences of opinion as to the definition and diagnosis of the syndrome, certain criteria as already stated were arbitrarily laid down in the selection of cases in this series. It may be stated here that during the period of study a number of other cases who showed similar clinical features but not the albumino-cytological dissociation in the C.S.F. (protein content under 60 mg. per cent and slightly raised cell count) were also encounted but were excluded from this series to avoid confusion. The differences of opinion between the dominant schools of thought have been discussed well by Leneman (1966), Osler (1960) and Hills (1967).

Most of the patients in the present series were referred cases—referred by different hospitals or general practitioners with a provisional diagnosis of poliomyelitis. Thus the author is in complete agreement with Seth (1965) that the condition is often missed or wrongly diagnosed as poliomyelitis in our country. In poliomyelitis, the onset of paralysis is rather abrupt following the prodromal illness with features of meningeal irritation. The paralysis is usually maximal at the onset and usually does not spread. Spreading paralysis is more often in favour of polyradiculo-neuropathy. Sensory impairment is absent in poliomyelitis. Muscular involvement is usually patchy and asymmetrical in poliomyelitis. Lumbar puncture will confirm the diagnosis. A normal cell count with a high rise of protein content in the C.S.F. is characteristic of polyradiculo-neuropathy. In poliomyelitis, there might be a slight to moderate rise of C.S.F. protein towards the third and fourth week of illness when the cell count may be normal (Steigman 1969). Thus the physician may have to depend more on clinical features in such cases. The age distribution of poliomyelitis in this country is also characteristic. Over 95 per cent of cases of poliomyelitis occur under the age of 6 years with the peak incidence between 1 to 2 years of age (Basu 1963, 1966). Clinical suspicion should therefore be more in favour of polyradiculo-neuropathy in patient over 6 years of age.

According to Brain (1962) most of the reported cases of the Guillain-Barré syndrome occurred between the ages of 20 and 50 years. All the cases in the present series except one were children below 15 years of age which was obviously due to the study being undertaken in a children's hospital.

The Landry Guillain-Barré syndrome has been reported from India by Jolly and Chuttani (1956), Singh and Jolly (1958). Taori and Chandi (1963), Chuttani and Chawla (1968) and Mittal *et al.* (1969). However the present series appears to be the largest so far published from India. As regards the occurrence of the disorder in children, Taori and Chandi (1963) reported the maximal incidence in the first decade in their series of 44 patients. Seth (1965) reported 8 cases in children from Varanasi. From West Bengal, Basu (1968) reported 3 cases in children and Chakraborty (1968) one case.

In the present series, males have outnumbered the females. A review of the reported cases also showed similar findings (Brain 1962, Taori and Chandi 1963, Mittal *et al.* 1969). The reason appears to be far from clear.

According to Sheldon (1955) and Davidson (1971) the weakness in this syndrome is more pronounced in the proximal muscles. According to Williams (1966) muscles are uniformly affected proximally as well as distally. In the present series, the distribution of weakness has been predominantly of the distal type which is in agreement with the findings of Guillain, Barré and Strohl (1916) and Walsh (1958).

The high incidence of bulbar paralysis in the present series may possibly be explained by the fact that only severe cases could be admitted due to paucity of beds. However fatal cases who succumbed were not included in this series as they could not be investigated properly. Hence no inference can be drawn from this study regarding the mortality in this disorder.

The etiology of the condition is still obscure but the pathological changes are more or less characteristic and distinctive. There is degeneration of spinal nerves including nerve roots and ganglia and infiltration by inflaammatory cells. Usually the central nervous system does not show any consistent change. It has been postulated that the syndrome is a non-specific reaction to several infective agents due to an abnormal antigen-antibody response (Campbell 1957). Melnick (1963) detected circulating complement fixing antibodies to nervous tissue in 50 per cent of his 38 patients studied. Waksman and Adams (1955) have produced identical lesions in rabbits by injection of peripheral nervous tissue. All these studies lend support to the concept of the entity being a hypersensitivity reaction or auto-immune disorder—the etiology being of a varied nature.

Of 1100 cases reviewed by Leneman (1966), one-third were found to be without any demonstrable cause. The remaining cases were found to be associated with infectious diseases, allergy, endocrine disturbances, toxins, neoplasms and a host of other conditions. Leneman (1966) therefore contended that these associations might not be etiological and frequently multiple factors were implicated. The condition has been reported after measles (Debré and Thieffry 1961), rubella (Haymaker and Kernohan 1949), chicken pox (Welch 1952), mumps (Brain 1962), infectious mononucleosis (Nixon 1952) and prophylactic inoculations (Millar and Stanton 1954). The condition is very often preceded by respiratory tract infections. Out of 44 cases Taori and Chandi (1963) could elicit the history of sore throat in 23 cases (52.2%). The Landry-Guillain-Barré syndrome has been recorded after antirabic vaccination by Taori and Chandi (1963) and Gupta *et al.* (1964). Laha (1957) also reported 2 cases of polyneuritis caused by antirabic vaccination.

In the present series, a history suggestive of respiratory tract infections was elicited in 33 cases, skin lesions in 23 cases, measles in 5, and chicken pox, pertussis and mumps in one each. There was a history of inoculation with

diphtheria, tetanus and pertussis prophylactic in 3 cases, antirabic vaccination in 3, smallpox vaccination in 2 and oral polio vaccine in 2 cases. In the cases following antirabic vaccinations, the symptoms started after the 8*th* or 9*th* injection.

In addition to the associations already stated, 40 patients in this series were found to be suffering from ascariasis as well. In a random 600 cases in the same hospital, the presence of ascariasis was found to be recorded in 3 per cent of cases. The attention to ascariasis in this disorder was first drawn in 1971 by a male child, aged four years, with characteristic symmetrical paralysis of all four limbs, who had convulsions after admission and passed a number of roundworms on the hospital bed. His C.S.F. protein content was 620 mg. per cent, the highest of the series. Prior to this case, a history of passage of roundworms was not specifically elicited or routine stool examination was not done. Thus the actual incidence of ascariasis might have been even higher. A further study on the possible role of ascariasis in this syndrome is being pursued.

Sumary and Conclusions

One hundred and twenty cases of polyradiculo-neuropathy (Landry-Guillain-Barré-Strohl syndrome between the ages of 1 and 17 years have been studied. The maximum number of cases (46 cases or 38.33 per cent) occurred in the age group of 3 to under 6 years. Males were more frequently affected than females., The pattern of involvement was predominantly ascending in nature. The distal group of muscles were observed to be more frequently affected than the proximal muscles. The protein content of the C.S.F. ranged between 60 and 620 mg. per cent in this series. Ninety two patients have recovered fully so far. Of them 80 patients recovered within one year. Forty patients were found to be suffering from ascariasis as well and a further probe on the possible role of ascariasis seems desirable.

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