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CLINICAL FEATURES OF THE POLIOMYELITIS EPIDEMIC IN MALTA, 1942-3

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In Nov., 1942, when the siege of the islands had just been raised, Malta and its small neighbour Gozo were still further stricken by a serious outbreak of poliomyelitis, the first of any note in their history. Between Nov. 15, 1942, and the first week in June, 1943, there were 426 cases in the civilian population, almost all in children under the age of 5 years (Fig. 1).

At the same time 57 Service cases occurred, the victims being without exception men from the United Kingdom. The epidemiology of the outbreak has been discussed elsewhere by Seddon, Agius, Bernstein, and Tunbridge (1945). Bernstein, Clark, and Tunbridge describe the clinical features of the Service cases in this issue, at p. 727; the present paper is concerned with those of the civilian outbreak.

The occurrence of such an epidemic in a community where conditions are otherwise normal is no light matter. In a small island that had been subjected to prolonged and ferocious aerial bombardment, and that had hardly recovered from a food shortage verging on famine, the provision of adequate accommodation and treatment for over 400 cases of poliomyelitis was a task requiring exceptional resourcefulness and determination. Satisfactory accommodation was found within a remarkably short time in the new but uncompleted Government hospital (now known as St. Luke's), though for several months there was a shortage of equipment and of physiotherapists. Improvised wooden splints for the legs and calico slings for the arms were applied under the direction of Prof. J. E. Debono, and the supervision of these small children was so strict that a complete review of all cases made in March

and April, 1943, revealed only two in which there was very slight contracture. While the epidemic was in progress there was insufficient time for taking detailed histories of onset; furthermore, at that time many of the mothers were so distraught that it was impossible to obtain coherent stories from them. During February and March, when the state of emergency was coming to an end, one of us obtained detailed histories of onset in all except a very few cases. This information, together with the shorter notes made at the time of admission, gives a fairly clear picture of events during the active phase of the disease. In the spring of 1943 all but five of the survivors were re-examined and the muscle power charted according to the system of notation recommended by the Peripheral Nerve Injuries Committee of the Medical Research Council. This work was most laborious. In older children accurate muscle examination requires time and patience; in infants it is exceedingly tedious, and the results cannot always be regarded as strictly accurate. In every case of doubt a low rather than a high grading was given, and it may well be that the effects of this epidemic will prove less serious than the original forecast suggests. By early March, 1943, only 160 children were in hospital; in the case of out-patients living in towns remote from St. Luke's Hospital the detailed examinations were made at district dispensaries and, as a last resort, in the homes of patients whose parents lacked the means or the inclination to bring their children to a clinic. Under such conditions accurate work was not always possible.

Clinical Features of the Acute Disease

Onset

In some cases the illness was so mild that during the acute phase the child was not put to bed at all; indeed, the symptoms were often so vague that the disease was completely overlooked. In others it was mistaken for some other condition such as paralytic chorea, diphtheria, or meningitis. However, close questioning usually elicited a history of some general disturbance. In a few cases the onset was very acute, with convulsions that seemed to threaten life; it is probable that this was the state of affairs in the case of three patients who died at home. The duration of the acute illness varied between 1 and 17 days, though in most cases the general disturbance lasted for not more than four days. The detailed figures are as follows:

In 59 cases duration 1 day	In 9 cases duration 8 days
" 73 " " 2 days	" 5 " " 9 "
" 55 " " 3 "	" 9 " " 10 "
" 46 " " 4 "	" 1 " " 11 "
" 18 " " 5 "	" 4 " " 12 "
" 16 " " 6 "	" 1 " " 13 "
" 17 " " 7 "	" 8 " " 14-17 days
In 10 cases there was no systemic disturbance.	

Fever

Out of 396 cases 245 were pyrexial at some time during their illness, there being low fever (below 101°) in 159 and high fever (above 101°) in 86 cases. Rigors were observed in 18 cases. It is probable that fever was present in a greater number than is indicated by these figures, but our information is incomplete. The duration of fever varied; in 159 cases it lasted for not more

FIG. 1.—Diagram showing the age incidence of cases.

myelitis was a task requiring exceptional resourcefulness and determination. Satisfactory accommodation was found within a remarkably short time in the new but uncompleted Government hospital (now known as St. Luke's), though for several months there was a shortage of equipment and of physiotherapists. Improvised wooden splints for the legs and calico slings for the arms were applied under the direction of Prof. J. E. Debono, and the supervision of these small children was so strict that a complete review of all cases made in March

than 24 hours, which leads us to suspect that it passed unnoticed in many more. In 56 cases the duration was 2-3 days; 7 cases, 3-4 days; 11 cases, 4-5 days; 12 cases, more than 6 days. Twenty children were afebrile throughout. In a few cases the febrile disturbance disappeared, to reappear at about the time when paralysis developed. The febrile disturbance was present usually at the onset of the disease, though in a few it developed after the paralysis had appeared.

Pain

In view of the youth of most of the patients it is difficult to give the actual incidence of pain, and it may well be that the figures presented here are rather too low. In the very young pain manifested itself in various ways. A child would refuse to have his napkin changed, resented fondling or handling of any kind, and wished to be left alone. In several cases the child would not tolerate being bathed. In one case the mother noticed the child scratching the limb which later became paralysed; there was no local skin lesion. In two cases children complained of a pricking sensation in the limb about 48 hours before the development of paralysis.

The site of pain did not as a rule correspond with the distribution of the subsequent paralysis. For example, pain in the back was followed by facial or deltoid paralysis; pain in the face by paralysis of the lower limbs; pain in one lower limb by paralysis of an upper limb; pain in one lower limb by paralysis of both; and pain in the shoulders by facial palsy. In one case severe orbital pain was followed by paralysis of one lower limb. In another, suprasternal pain was followed by difficulty in swallowing, then by facial palsy. Headache occurred in 72 cases, and was unassociated with any particular kind of paralysis; the cases of cranial nerve palsy were usually unassociated with headache. Pain occurring in a limb which subsequently became paralysed was observed in only 28 cases.

The severity of the pain did not correspond with the extent or severity of the subsequent paralysis. Indeed, many children who complained bitterly of pain escaped with less paralysis than those who did not. In one case pain was severe for three days and nights; both lower limbs became paralysed and yet recovered completely. In a few cases the pain was recurrent and of short duration; in one it moved from limb to limb in a manner that was suggestive of acute rheumatism. On the whole pain was not an outstanding feature in this epidemic. In 96 cases the child cried intermittently as if in distress, and in 57 the crying was no more than a whine or a whimper. In 56 cases the pain was limited to one part of the body, and in 28 it appeared in the part which later became paralysed. Sixty-six children seemed to be sore all over and greatly resented handling; but this was the nearest approach to the characteristic muscle tenderness in acute poliomyelitis that was seen.

Nervous System

(a) *Somnolence* was noticed in 150 cases, and in some it was pronounced, the child having to be wakened for his feed, perhaps only to fall asleep again during the course of it. Many of the babies were extremely lethargic. Some children slept at unusual hours or were late in waking up. During the period of sleep or drowsiness a number of children (107) exhibited jerking movements, which were the occasion for considerable alarm. One hundred children had restless nights, though this feature corresponded fairly closely with the incidence of fever. In 6 cases there was a reversal of the sleep rhythm, the child sleeping by day and being restless at night.

(b) *Delirium* was noticed in only 20 cases, and occurred generally at night; 13 children had convulsions. Four children lost consciousness for periods of up to 12 hours.

(c) Seven children and one adult complained of *vertigo*; one child said repeatedly that he felt like a drunken man, and an adult made a similar complaint. Another child complained that the bed was spinning round, and said he felt dizzy and was going to fall; the vertigo was accompanied by vomiting. In two cases vertigo was aggravated by changing the child's position in bed or by raising the head from the pillow. In one of the cases of vertigo there was a cerebellar disturbance. One child could not tolerate street noises.

(d) *Stiffness of the back* was remarkably infrequent; it was observed in only 7 cases. Spasmodic contraction of muscles followed by paralysis occurred in only one case. Tremors and involuntary movements were present in 7.

(e) Thirty-eight patients were very *irritable*, even to the extent of throwing things at those who attended them; in 22 cases there was

a noticeable change in temperament. Two patients were extremely apprehensive; one of them—the adult who died—was sure long before the end that his illness would be fatal. A rather similar fear seemed to be present in the minds of other children, who complained bitterly when left alone.

(f) *Loss of speech* occurred in 6 cases, in three of which there was facial palsy; one child in this group presented typical cerebellar symptoms and signs.

(g) *Twitching of the eyelids* was noticed in 11 cases, and strabismus in 2. One case developed bilateral ptosis. Nystagmus was not seen in any of the cases.

(h) *Paralysis*.—Except in the 10 cases in which there was no general disturbance it was difficult to determine the exact date of onset of the paralysis; the child was already ill, perhaps in bed, and neither the parents nor the child could say when the diminution in muscle power started. In addition to these 10 cases there were 9 in which a general disturbance followed the paralysis. In most cases the paralysis appeared fairly soon after the onset of the general disturbance; in dealing with such young children it was, unfortunately, impossible for us to be more precise. There were, however, several interesting exceptions. In 12 cases the paralysis developed a number of days after the general disturbance was over, when some children were actually going about again; in 10 the paralysis came on when the child had been up for two days, and in 2 it did not appear until after two weeks. In 13 cases there was, similarly, a general illness followed by apparently complete recovery; then there was a second period of malaise, at the end of which paralysis developed. One case was especially dramatic. A child was ill for a few days, and apparently had recovered completely; eight days later he was taken ill at 3 p.m., and 11 hours later died of respiratory paralysis. It is of course possible that the initial disturbance was not due to poliomyelitis, and it has recently been suggested that certain infections, particularly of the intestine, pave the way for entry of the virus by the alimentary portal.

In a number of cases there was an initial weakness of the limbs, which appeared to be of a temporary nature but later gave place to severe and long-standing paralysis. The weakness was revealed by unsteadiness, with frequent falls, which was often present for some time before the appearance of frank paralysis. In no instance was there an irregular spread of paralysis affecting one limb after another. In three cases the paralysis was ascending and fatal.

The results of examination of the cerebrospinal fluid will not be enumerated, as although lumbar puncture was performed on most cases admitted to hospital the information gained was of no special interest.

A number of children were vaccinated against smallpox or received injections for one reason or another a short time before the onset of poliomyelitis. The four vaccinated cases were inoculated at the usual site in the upper limb, and the subsequent paralyses were as follows: (a) vaccination in left upper limb—paralysis of same limb; (b) vaccination in left upper limb—paralysis of right upper and both lower limbs; (c) vaccination in left upper limb—paralysis of left lower limb; (d) vaccination in left upper limb—paralysis of face, left upper and lower limbs. One child was receiving intramuscular injections for whooping-cough; both upper limbs had been injected, and he developed paralysis in one. Five children were receiving antimony compounds intravenously or intramuscularly for leishmaniasis, but in no case could the site of injection be correlated with that of the subsequent paralysis. There is therefore no conclusive evidence that the virus was accidentally introduced by injection.

Alimentary and Respiratory Systems

Anorexia was almost constant, and 12 children complained particularly of thirst. Salivation unrelated to teething was noticed in 14 cases; it was not followed by one form of paralysis rather than another. Dysphagia was present in 5 cases. Vomiting occurred mainly at the onset of the illness, and was observed in 117 cases; it occurred only once in 99, twice in 11, three times in 2 cases, and repeatedly in 2 others. Late and persistent vomiting occurred in 4, retching and vomiting in 3 cases, the retching being a marked feature throughout the acute phase of the illness; retching in the absence of vomiting occurred in 4 cases. Abdominal pain without difficulty in micturition was noticed in 42 cases; it was never persistent, and was easily relieved by hot fomentations; 108 children suffered from constipation—usually obstinate and relieved with difficulty; diarrhoea was present in 5 cases, diarrhoea and tenesmus in 1 case.

An initial coryza was noticed in 80 cases, 6 children had sore throats, and in 28 a cough was present ; hoarseness of the voice or cry was observed in 4 cases.

Urinary System

Several children suffered from retention of urine; in other cases the child took a long time to start or complete the act of micturition. In only one case was catheterization necessary.

None of the visceral symptoms that have been described were apparently due to local disturbances, and it was therefore not unreasonable to regard them as manifestations of the ingravescent disease ; it was of interest, perhaps of importance, to determine whether symptoms referable to one particular system or body level were followed by paralysis of characteristic distribution. The results of this inquiry were as follows:

	Cases
Gastro-intestinal symptoms followed by paralysis of	
Face	10
Lower limbs	108
Face and lower limbs	2
Upper limbs	16
Respiratory symptoms followed by paralysis of	
Face	2
Upper limbs	5
Lower limbs	50
Gastro-intestinal and respiratory symptoms followed by	
paralysis of	
Upper limbs	6
Lower limbs	26

Difficult micturition was followed indifferently by paralysis of the upper or lower limb.

Thus it may be concluded that there is no obvious relation between the mode of onset of the disease and the distribution of the subsequent paralysis.

Oedema of the eyelids was a presenting sign in 2 cases; both were sent in with a diagnosis of nephritis, and in neither was any evidence of kidney damage detected subsequently. In 3 cases swelling of joints was an early but transient phenomenon.

Causes of Death

Fifteen patients succumbed to the disease, death being due to respiratory paralysis in 14 and to convulsions in 1; death rate, 3.5%. Twenty-three children died from intercurrent disease, the actual causes of death being the same as those commonly found in the 0-5 years age group in Malta. It is possible that in several cases the paralysis was a contributory cause of death, but even if all fatalities are included the total death rate of 9.0% is not high in an epidemic of some magnitude; it has been suggested elsewhere (Seddon *et al.*, 1945) that this is evidence in favour of the virus being native to Malta rather than imported from another country. By contrast, the death rate among the Service cases was 19.3%, all but two of the fatalities being due to respiratory paralysis; two late deaths were attributed to cerebral anoxia.

Distribution of Paralysis

The original distribution of paresis or paralysis in all the cases is shown in Table I. It will be noticed that the lower

TABLE I.—*Distribution of Muscular Paresis or Paralysis (426 Cases)*

Lower limbs	57
One lower limb	162
Lower limbs; abdominal and spinal muscles	40
One lower limb; abdominal and spinal muscles	33
Upper limbs	3
One upper limb	42
One upper limb and one lower limb	16
One upper limb and both lower limbs	7
Both upper limbs and one lower limb	1
Both upper limbs and both lower limbs	1
One upper limb and both lower limbs; abdominal and spinal muscles	12
Upper and lower limbs; abdominal and spinal muscles	8
One upper limb and one lower limb and spinal muscles	2
One upper limb; abdominal and spinal muscles	3
Abdominal and spinal muscles	4
Facial muscles	29
Generalized weakness	6

NOTE.—Facial paralysis occurred in 18 cases with paralysis elsewhere, so that the facial muscles were affected in 47 cases, or in just over 11% of cases. The sixth cranial nerve was involved in two cases in association with paralysis of the lower limbs. One of these also had a facial palsy. The incidence of respiratory paralysis is not shown; there were 15 cases among the 426.

limbs alone were affected in 219 cases (51%), and in association with paralysis of other regions in 120 cases, bringing the total of lower-limb paralyses to 339 (79.5%). The upper limbs were involved alone in 45 (10.5%), and with others in 50 ; cases with

upper-limb paralysis thus total 95 (22.3%). The abdominal and spinal muscles were affected in 102 cases (23.9%); all except four had paralysis elsewhere. Facial paralysis occurred in 47 cases (11%); 29 of them showed no other abnormality. The spinal segmental involvement is shown in Fig. 2.

FIG. 2.—Spinal segmental distribution of paralysis in civilian cases, showing great lumbo-sacral predominance. (Reproduced by courtesy of the Editors of the *Quarterly Journal of Medicine*.)

Treatment

At first the only physiotherapists available were one masseuse and one voluntary assistant. An after-care sister from the Wingfield-Morris Hospital, Oxford, went out with one of us (H. J. S.) at the end of Feb., 1943, and remained in Malta until the end of August. The Army generously permitted the masseuse in charge of the military cases to spend nearly half of her time at the civil hospital, and thus, with the assistance of junior medical officers and V.A.D.s who were given special courses of instruction, it was possible to build up a physiotherapy service which, although admittedly inadequate, was entirely effective in preventing deformity and in providing muscle re-education for such children as were old enough to co-operate. In spite of the language difficulty it was remarkable how intelligent youngsters of 3 or 4 could be taught to carry out exercises appropriate to their individual needs.

Since most of the children were under 5 years of age plaster-of-Paris proved unsuitable for splinting the lower limbs. It was necessary to provide durable splints that would not rust. Thanks to the generosity of Air Vice-Marshel Sir Keith Park, the Air Officer Commanding, we were able to obtain sheet duralumin, from which simple but very effective splints were made. They were even lined with spongy rubber sheeting salvaged from German aircraft. For cases of paralysis of the trunk muscles Bradford frames made of gas-piping were used, the patient being supported by canvas slings and held securely by a linen jacket. Owing to the pressure of work we had at first to be content with plaster-of-Paris and light wire splints for use in paralysis of the upper limb.

The provision of a swimming-pool was not thought to be desirable. It would have been available for only a limited number of patients, it would require an abundant supply of water and fuel—there was a shortage of both—and it would have been necessary to install some form of water-disinfecting plant. Scabies and impetigo were rampant at that time. A suspension apparatus was nearly as satisfactory. Five of these appliances were made, being constructed in such a way that they could be taken to pieces and transported to a clinic by car. The woodwork was done by the carpenter at St. Luke's Hospital, and the springs and other metal fittings were supplied by Col. H. D. Tanner, of the Royal Engineers.

It was estimated that at least 150 children would require some kind of permanent apparatus. A workshop for the supply of "irons" is now in being; the materials necessary for making a start were sent out by the Crown agents, with a supply of boots, of which there was until recently an almost complete dearth.

Recovery

Table II shows the recoveries that were complete by Sept., 1944, while in Table III are details of the recoveries in the cases that still show signs of paralysis of another part of the body.

TABLE II.—*Complete Recoveries*

Distribution of Paralysis	Recovered Within (Months)										Total
	1	2	3	4	6	9	12	15	21		
Lower limbs	2	4	17	1	1	2	1			28	
One lower limb	2	6	30	2	1	4	9		1	55	
Lower limbs; abdominal and spinal muscles			3		2	3	1			9	
One lower limb; abdom- inal and spinal muscles	1	1	3		2	2	1			10	
Upper limbs			1							1	
One upper limb	1	4	9			1	4			19	
Upper and lower limbs; abdominal and spinal muscles					1					1	
One upper and one lower limb	1		1							2	
One upper and both lower limbs			1				1			2	
Facial muscles	4	3	13				1			21*	
Abdominal muscles ..			1					1		2	
Generalized weakness ..		2								2	
Total	11	20	79	3	7	12	18	1	1	152	

* Four other cases of recovery from facial paralysis are not specified in the table but are included among those which recovered from paralysis elsewhere.

TABLE III.—*Partial Recoveries*

Recovery of	Within (Months)										Total
	2	3	4	6	9	12	15	18	21		
Lower limbs		2								2	
One lower limb		2	4	3		5	1			15	
Upper limbs	1									1	
One upper limb	2	1				3		1	1	8	
Lower limbs and spinal muscles				1	1					2	
One lower limb; abdominal and/or spinal muscles		1		2	4	3				10	
One upper and one lower limb								1		1	
One upper limb; abdominal and/or spinal muscles						3				3	
Abdominal and/or spinal muscles			1	3	7	18	4	1		34	
Facial muscles	2	3				1				6	
Face and one lower limb ..							1			1	
Face; one upper and one lower limb						1				1	
Face; upper limbs and spinal muscles						1				1	
Total	5	9	5	9	12	35	6	3	1	85	

Of the 388 survivors 152 (39.2%) made a complete recovery within 21 months (Table II); and of the 152 about two-thirds (110) recovered within the first three months—which happened to be the period when the provision of physiotherapy was very meagre. This early and unassisted recovery cannot be explained in terms of axonal regeneration; it must represent the return of function in comparatively normal anterior horn cells whose activities had been merely suspended by the disease. There is another peak in the 9–12 months period, when 30 more cases made a complete recovery; but the table suggests that in spite of adequate physiotherapy, such as became available four months after the outbreak of the epidemic, there is not much to be hoped for in the cases still paralysed after 12 months unless a still later peak is found indicating recovery due to axonal regeneration. It may well be that the 30 cases that recovered in from 9 to 12 months were those in which deliberate muscle re-education was required to complete the restoration of function. A more recent, though admittedly incomplete, review of the cases in Jan., 1945, 26 months after the outbreak of the epidemic, is not encouraging; there have been no spectacular improvements since the twelfth month.

The main peak of partial recovery in the cases which still show some paralysis (Table III) was between 9 and 12 months, which suggests that in the more severely paralysed patients physiotherapy may play an important part in bringing about such recovery as occurs.

No fewer than 102 patients suffered from abdominal or spinal paralysis, or both, usually in association with paralysis of other parts of the body. Fortunately only 21 patients have failed to recover good power in the abdominal and spinal muscles, and it is to be hoped that the incidence of structural scoliosis will be low.

The high incidence of facial paralysis—47 cases—was a remarkable feature of the epidemic; in 10 some degree of

paralysis is still present and the prognosis must be regarded as bad. In the 29 cases in which there was no associated paralysis the diagnosis of poliomyelitis was based on (1) the absence of other causes, (2) the presence of the same kind of general disturbance as was observed in children suffering from paralysis of the limbs, and (3) the occurrence of the facial paralyses during the epidemic period. The recovery rate was much the same in those cases in which other parts were paralysed as it was in those in which facial involvement occurred as an isolated phenomenon.

A Plan for the Future

It was suggested to the Secretary of State for the Colonies and to the Malta Government that an orthopaedic service should be established to provide not only for the long-term care of the victims of the epidemic but for cripples of every kind. This proposal was received with enthusiasm, and in July, 1943, two more masseuses from England went out to Malta, where, under the guidance of Prof. P. P. Debono, professor of surgery in the Royal University of Malta, they established a physiotherapy department at the Bugeja (Central) Hospital in addition to taking over the work already started at St. Luke's. It is planned to train several Maltese girls at physiotherapy schools in this country, and during their time of training and for some time after they return to Malta the physiotherapy staff will be augmented by two more physiotherapists sent out from Britain.

Mr. A. J. Craig, a Maltese surgeon with experience of general and orthopaedic surgery in this country, has recently been appointed to take charge of orthopaedics in the Maltese Medical Service: he is now organizing his department, and has also been proposed for the post of Lecturer in Orthopaedics in the Royal University. The junior surgeon who was placed in charge of the cases of poliomyelitis from the time of the epidemic until Oct., 1944, is now in this country gaining further experience in general and orthopaedic surgery. In due course he will return to Malta as assistant orthopaedic surgeon. The orthopaedic workshop will form part of the permanent organization.

Conclusions

The clinical aspects of the Malta epidemic presented few unusual features. There are, however, one or two points to which attention should be directed.

One of the earliest and, apparently, most constant signs described by other observers is stiffness of the neck and back, so that the patient is unable to approximate the chin to the bent knees. This phenomenon is sometimes referred to as the "spine sign," but its diagnostic significance is evidently doubtful, since not only may it be absent in most cases of poliomyelitis, as in our series, but it may occur in any condition associated with meningeal irritation. The lack of any definite correlation between the prodromal subjective and objective phenomena on the one hand, and the distribution of the eventual paralysis on the other, is as striking as it is unfortunate; not only is the clinician deprived of a valuable pathfinder, but he may even be thrown off the scent by having all his attention directed away from the silent paralysis by the clamour of symptoms such as pain in another part, vomiting, etc. This state of affairs may furnish one explanation for the "missed cases" in an epidemic.

In most disease processes the value of pain as an early localizing symptom is well recognized; it was therefore disturbing to find that the site of pain gave little or no indication as to the site of the subsequent paralysis. Muscle tenderness was also inconspicuous. The same was true of the visceral symptoms: there was no more likelihood of a patient developing paralysis of the lower limbs after a gastro-intestinal upset than after a prodromal respiratory disturbance. The occurrence of paralysis of the lower limbs in four out of every five of our cases is in keeping with the findings reported by most other observers.

A curious feature of the epidemic was the high incidence of facial paralysis. It was invariably unilateral, and in the majority of cases disappeared during the first three months. Persistence of the paralysis after that period was accompanied by reaction of degeneration in the affected muscles, and the prospect of recovery must be extremely poor. This was also

our experience with regard to paralysis of any part of the body. The largest number of recoveries took place during the first three months after onset—at a time (as it happened) when little physical treatment was available. A second though much smaller peak in the recovery rate, which occurred during the 9–12 months period, may have been due in part to the influence of treatment. Although the part played by physiotherapy seems to be small, in that no known treatment can bring about regeneration of grossly damaged anterior horn cells, the prevention of contractures and the maintenance of joint mobility are of great value. When recovery is slow and imperfect the importance of muscle training is especially noteworthy. It is therefore only in the early and complete recoveries that physical treatment seems superfluous.

The care of the victims of this epidemic was and still is the work of a team. In addition to those whose names appear in the text we express our thanks to Prof. A. V. Bernard; to the resident medical staff of St. Luke's Hospital, especially to Dr. O. Azzopardi and Dr. V. Zammit-Tabona; to the physiotherapists, Mrs. K. J. Bell, Miss E. J. Charter, Miss P. Empson, Mrs. M. T. Ensoll, and Miss M. B. Quinton; and to the Reverend Mother Superior and her devoted staff of nurses.

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ACUTE ANTERIOR POLIOMYELITIS AMONG SERVICE PERSONNEL IN MALTA

AN ACCOUNT OF AN EPIDEMIC

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An account is given of the clinical pathological, and therapeutic findings in a series of 57 cases of acute anterior poliomyelitis occurring among Service personnel during the Malta epidemic of the winter of 1942–3. The epidemiological findings of the outbreak have been fully discussed elsewhere by Seddon, Agius, Bernstein, and Tunbridge (1945). Only 4 out of a total of over 400 cases were recorded among the adult Maltese population and none at all among the Maltese troops. The apparent immunity of the Maltese troops is the more striking because they were often working side by side with United Kingdom troops.

Of the 57 cases 2 were from the Royal Navy, 27 from the Army, and 28 from the Royal Air Force. The incidence was proportionately higher among the R.A.F. than among the Army personnel, being 4 to 1. The duration of service in Malta bore no relation to the disease. The average duration among affected personnel was over 12 months (Table I). The four cases with

TABLE I

Duration of stay in Malta:		Period of service:	
1 month and under	4	Minimum	2 weeks
1 to 6 months	7	Maximum	5½ years
7 to 12 "	4	Average	Over 12 months
13 to 24 "	31		
Over 2 years	11		

less than one month's service in the island arrived after the onset of the epidemic. The average duration of the disease before admission to hospital was 3.6 days, with a range from 12 hours to 15 days.

The Preparalytic Stage

In only two instances was information regarding the preparalytic stage not available. In two further cases no paresis developed, and in five additional cases the exact duration was difficult to assess as there was in each instance a history of illness followed by a period of normality lasting 3 to 12 days before the return of symptoms and the onset of paralysis. The average duration of the preparalytic stage in the remaining 48 cases was 3.4 days (Table II).

The proportion of non-paralytic cases was unusually low, and undoubtedly some cases were missed. On the other hand, the medical officers and all the troops were aware of the prevalence of anterior poliomyelitis, with the result that almost all those complaining of headache and fever during the peak period of the epidemic had a routine examination of the cerebrospinal fluid on admission to hospital. By this procedure the diagnosis was established in the two recorded non-paralytic cases.

TABLE II.—Duration of Preparalytic Period

12 cases 24 hours or less	6 cases 4 days
6 " 2 days	7 " 5–7 days
11 " 3 "	6 " 8 days or more
(Average 3.4 days)	
5 cases with uncertain preparalytic period	
(2 or 10, 5 or 14, 3 or 15, 1 or 4, 3 or 10 days);	
2 cases, no paresis; 2 cases, data not available	

Symptoms.—In 36 cases the onset was sudden and dramatic, the patient presenting some of the symptoms and signs of meningeal irritation. Headache was the most prominent initial symptom, and was recorded in 45 cases (Table III). No new

TABLE III.—Preparalytic Symptoms in 53 Cases

Headache	45	Anorexia	8
Muscle weakness	26	Vomiting	6
Pain in back	21	Lassitude	6
" neck	14	Urinary symptoms	5
" limbs	13	Abdominal pain	4
Malaise	14	Dysphagia	3
Sore throat and coryza	13	Weakness of eyes	2
Shivering attack	11	Miscellaneous	5

symptoms were observed, nor was there a constant clinical picture applicable to the majority of cases.

Signs.—Pyrexia was noted in 43 cases on admission to hospital, and ranged from 98.8 to 104° F. The fever lasted from 48 hours up to eight days, save in six cases in which the development of secondary infection, respiratory or urinary, prevented an accurate assessment of the duration of pyrexia attributable to the primary disease. Neck rigidity was observed in 20 cases, neck stiffness in 17, Kernig's sign and the spine sign in 12.

The Paralytic Stage

Twenty-six patients complained of weakness of a limb or other part of the body before admission. Muscle tenderness was noted in 30 cases, but in only six did it present with any degree of severity longer than 10 days after the onset of the paralysis. The degree of muscle tenderness bore no relation to the severity of the muscle paresis. In the present series the degree of paralysis was by no means maximal within 24 hours of onset (Table IV).

TABLE IV.—Cases with Delayed Spread of Paresis

Cases		Cases	
2 days	2	6 days	1
3 "	3	9 "	1
4 "	3	10 "	1
5 "	2		
(In 8 cases delayed 4 days and over)			

The spread of the paralysis was descending in 10 and ascending in 3 cases. In 15 cases the development of the paralysis was not continuous, but was of the "jumping" variety, with an interval of at least 12 hours between the jumps. Included in the jumping cases were nine of the descending and three of the ascending type of spread. Accurate assessment of the extent and the degree of paralysis in the initial stages was often a matter of considerable difficulty. In our experience neither the degree of loss of power nor the degree of alteration of the reflexes was of itself an adequate guide to the severity. Some cases with absence of reflexes in the early stages made a dramatic recovery of power, and vice versa. Further, despite repeated and careful examination, muscles apparently unaffected initially, or even after 10 days, showed definite weakness three to five weeks later. The latter feature is of considerable clinical significance and necessitated keeping the patients in bed for at least four, preferably six, weeks. However trivial the initial paralysis may seem, it is only by keeping the patient in bed for such a period that the extent of the paralysis can be fully assessed and the development of deformity minimized.

Case 14.—Sgt. H., aged 21. Admitted to hospital with a two-days history of headache and pain in the neck. The next day he developed weakness of the muscles of the right shoulder, mainly of the right deltoid. Cerebrospinal fluid: 88 cells per c.mm. (poly-