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POLIOMYELITIS AND IMMUNIZATION AGAINST WHOOPING-COUGH AND DIPHTHERIA

BY

H. STANLEY BANKS, M.D., F.R.C.P., D.P.H.
Senior Physician, Park Hospital, London, S.E.13

AND

A. J. BEALE, M.B., B.S.
Public Health Laboratory Service

Following upon the reports of McCloskey (1950), Martin (1950), and Geffen (1950), we searched the records of our cases of poliomyelitis admitted to the Park Hospital during the years 1947–9 for evidence of any relationship between the onset of poliomyelitis and recent immunization. We found that two cases of paralysis of the arm occurring within three weeks of an immunizing injection in the same arm had been specially noted in the case records in 1947, but after that no further cases had been observed until July, 1949, when a more acute awareness of the problem began to develop in London. One of us (H. S. B.) reported five such cases in the annual report of the hospital for 1949. We were, however, somewhat surprised to discover no fewer than seven further cases by systematic search of the records and by following up clues with letters of inquiry to parents and public immunization clinics. This made a total of at least 14 (12.6%) such cases, all of them children under 5 years of age, among 111 paralytic poliomyelitis cases of all ages admitted during the period (Table I). Confirmation of the facts regarding date, site, and nature of the immunizing injection was obtained in practically all cases from the immunization clinics. No instance was observed of any relationship between immunization and non-paralytic poliomyelitis.

It is not our purpose to make any estimate of the statistical significance of our data. This has been done on a more adequate scale by Bradford Hill (1950). But, while we merely record the data observed in one hospital, it is pertinent to mention two facts. First, the incidence of poliomyelitis in England and Wales, including London, in 1947 and 1949 was the highest on record, but was much lower in 1948 (18 and 14 per 100,000 population in 1947 and 1949 and 4 per 100,000 in 1948). Secondly, the number of young children immunized against diphtheria and whooping-cough was at a high and increasing level during these three years. There can be little doubt that there would be frequent overlapping of these occurrences, and that many children would be likely to be immunized at a time when they were actually infected with the poliomyelitis virus, although showing no clinical signs of it.

TABLE I.—*Paralytic Poliomyelitis: Admissions and Deaths*

	1947	1948	1949	Total
Cases admitted ..	40	12	59	111
Deaths	2	0	6	8

Table II shows the preponderance of lower-limb paralysis in the group who were not immunized or who were immunized over six months prior to onset of poliomyelitis, and

TABLE II.—*Incidence of Paralysis in Upper (U) and Lower Limbs (L) in Relation to Immunization History*

	1947		1948		1949		Total	
	U	L	U	L	U	L	U	L
No immunization history ..	7	9	3	1	7	12	17	22
Not immunized or immunized over 6 months before ..	7	15	2	4	11	24	20	43
Immunized within 2 months:								
(*a*) Total	5	0	3	1	4	2	12	3
(*b*) Inoculated limb ..	5	0	3	1	4	1	12	2

the preponderance, on the contrary, of upper-limb paralysis in the group who were immunized within two months of onset of poliomyelitis. This latter group with one exception consisted of cases in which the same "double event" occurred; namely (1) inoculation for whooping-cough, diphtheria, or both combined; and (2) within two months of one of the injections in the course, the onset of poliomyelitis with paralysis *of a practically uniform pattern in the same limb*. In the upper limb it was the muscles of the shoulder-girdle (deltoid, spinati, and pectorals) and the biceps and triceps which were invariably the first to be paralysed, and were often the only muscles seriously paralysed, although weakness was not uncommon also in the neighbouring muscles of the trunk and forearm. Occasionally the other arm was also, but less extensively, affected, and in one case the paralysis starting in the inoculated arm rapidly became general and was fatal. In the lower limb the pattern was similar. The muscles of the inoculated buttock and thigh were the earliest and most seriously affected, the paralysis being restricted to the inoculated limb in nine cases, and spreading also to neighbouring muscles in five cases. Where neighbouring muscles were affected, in both upper and lower limbs, there was usually considerable return of function in them within three months, but not in the muscles first paralysed—namely, those of shoulder-girdle and upper arm, or buttock and thigh. There was no particular grouping of the cases in time or in place—for example, in association with any particular clinic, instruments, or batch of prophylactic.

The preponderance of upper-limb paralysis in those immunized within two months suggests the influence of the inoculation in determining the site of paralysis, since inoculations in London are much more frequently done in the arm than in the leg. The only exception in this group was a child of 10 months who, eleven days after a first injection of diphtheria alum-precipitated toxoid in

the left arm, developed poliomyelitis with paralysis of the left buttock and thigh. She has not been included among the 14 cases of "related" inoculation and paralysis.* (Two further cases of interest in this connexion were a child of 6 years who developed paralysis of the right shoulder girdle and upper arm 15 days after tonsillectomy in May, 1947, and a child of 4 years who developed paralysis of the left shoulder-girdle and upper arm 15 days after tonsillectomy in October, 1949.) There was no reason to doubt the diagnosis of poliomyelitis in these cases, the stages of general symptoms, meningeal irritation, and paralysis, together with the spinal-fluid findings, all being characteristic.

In Tables III–VI are given data concerning the 14 cases (10 males and 4 females).

TABLE III.—*Cases of Paralysis in the Inoculated Limb in Relation to Prophylactic Used*

	1947	1948	1949	Total
Combined A.P.T. and pertussis	3	2	4	9
Pertussis	1	—	—	1
A.P.T.	1	2	1	4
Total	5	4	5	14

TABLE IV.—*Interval Between Inoculation and Paralysis*

Days After Last Inoculation	Cases
4	2
9–24	10
45	1
30–60*	1

* The exact date of onset of paralysis in this case was obscured by a severe intercurrent pneumonia.

TABLE V.—*Stage of Immunization and Paralysis*

Order of Last Inoculation	Cases
1st in course	5
2nd ,,	5
3rd ,,	3
4th ,,	1

TABLE VI.—*Age Incidence*

Age	Cases
Under 1 year	5
1–2 years	7
4–5 ,,	2

Summary and Conclusions

Inquiry into the cases of poliomyelitis admitted to one London hospital during the years 1947, 1948, and 1949 showed a total of 111 paralytic cases of all ages admitted during the period. Of these, 14, all under 5 years old, had a paralysis of the limb which had received one or more of a course of immunizing injections within the previous two months. The interval between the last injection and the onset of paralysis in the majority of the cases was between 9 and 14 days. The paralysis followed combined pertussis and diphtheria (A.P.T.) prophylactic in nine cases, pertussis vaccine alone in one case, and diphtheria prophylactic A.P.T. alone in four cases. The paralysis, whether of arm or leg, conformed in general to a uniform pattern. It was not associated in time or place with any particular clinic or technique. It is concluded that during periods of high or moderately high prevalence of poliomyelitis there is a definite but probably small risk that inoculation with the type of whooping-cough and diphtheria prophylactic usually employed in this country will be followed by serious flaccid paralysis of the inoculated limb in young children. The paralysis particularly affects the muscles adjoining the site of inoculation.

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Medical Memoranda

Simple Method of Treating Injuries of the Fingers

When a bone is fractured or a joint dislocated or sprained it is usually necessary to immobilize the affected part until the damaged tissues have had time to heal. Immobilization of the fingers is apt to result in stiffness of the joints, and if continued over a long period there may be some permanent limitation of movement. If, on the other hand, movements are begun early to prevent joint stiffness, there is often considerable discomfort and delayed healing of the torn joint capsule and collateral ligaments, with persistent painful swelling of the joint for several months.

On examination of a sprained finger-joint, either interphalangeal or metacarpo-phalangeal, the movements of flexion and extension are relatively painless, but attempted abduction and adduction movements, which stretch the damaged collateral ligament, produce pain. This is very severe in the interphalangeal joints, in which no side-to-side movement normally takes place, but is also found in the metacarpo-phalangeal joints, in which a considerable range of abduction and adduction is present in the extended position.

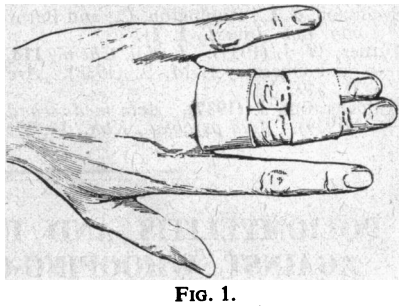

FIG. 1.

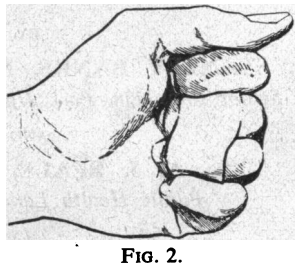

FIG. 2.

It is therefore desirable to prevent lateral movements of the sprained joint whilst encouraging active flexion and extension to prevent stiffness, and this can be achieved by the simple expedient of strapping the injured finger to an adjacent uninjured finger.

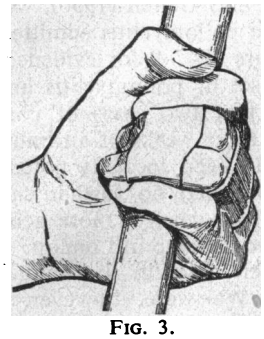

FIG. 3.

The index, middle, and ring fingers have their joints sufficiently near the same transverse axes for there to be no restriction of normal movement when they are strapped together, especially if an elastic adhesive strapping is used and applied with only slight tension. The fifth finger is shorter than the others, and when strapped to the ring-finger the normal movements are restricted, but there is still a sufficient range to prevent any permanent stiffness.

The illustrations show the method of application. Two strips of elastic adhesive strapping 1 in. (2.5 cm.) wide are applied transversely around the two fingers with the joints fully extended; the interphalangeal joints are left uncovered as much as possible. The elasticity of the