STABILITY OF THE POTENCY OF POLIOMYELITIS VACCINE

BY

F. T. PERKINS, M.Sc., Ph.D.

AND

RISHA YETTS, B.Sc.

*Biological Standards Control Laboratory, Medical
Research Council Laboratories, London, N.W.3*

In most countries poliomyelitis vaccine is given an expiry date of six months from release, provided that the storage temperature approximates to 4° C. So far this has caused little inconvenience, since the demand has exceeded the supply. When, however, the supply exceeds the demand a more realistic expiry date would be desirable. Some knowledge of the precautions that must be taken with the transportation of vaccine, especially to tropical countries, is also required. A study was therefore made of the loss in antigenic potency of vaccine stored at different temperatures.

FIG. 1.—Effect of storage at 4° C.

Materials and Methods

Storage of Vaccine.—Three different batches of formalin-inactivated vaccine were tested: batches 4 and 9, prepared in Britain by the Glaxo Laboratories, and batch E2769, in the United States of America by Eli Lilly and Company. All three batches contained MEF-1 and Saukett as the type 2 and 3 components respectively; as the type 1 component the British batches contained the Brunenders, and the United States batch the Mahoney strain. All were preserved with thiomersolate and “versene.” At the beginning of the storage period each batch was tested for antigenic activity. Samples from all three batches were stored at 4° C. and tested after 12 months, and an additional test was made with one of the batches after 21 months. Samples from batch 9 were also stored at room temperature (approximately 21° C.) and 31° C.; after 40 and 100 days at each temperature they were refrigerated at 4° C. and held at this temperature for three to five months, when the activities of all samples were tested in parallel.

Tests for Antigenic Activity.—For each test, groups of rhesus monkeys were injected with vaccine by the method in current use in the United States of America (U.S. Public Health Service, 1956). Each group consisted of 9 to 12 monkeys taken from the same con-

signment, weighing between 4 and 8 lb. (1.8 and 3.6 kg.). Before their course of injections the animals were shown to have no detectable poliomyelitis antibodies. They were given three intramuscular injections of vaccine, each of 1 ml., at intervals of seven days, and sera were collected seven days after the last dose. Sera were titrated for poliomyelitis neutralizing antibodies to each virus type by the method routinely used in this laboratory (Biological Standards Control Laboratory, 1957; Perkins, Sousa, and Tobin, 1958). In order to obtain comparable results, the sera from all monkeys were titrated against each virus type in one test, using a reference serum as a control. Mixtures of serum dilutions and virus suspensions were held at 37° C. for three hours and overnight at 4° C. before being added to the monkey-kidney-cell cultures, which were then incubated at 37° C. in roller drums and examined after seven days. Titres (PD₅₀) of sera are expressed as the dilution of serum in the serum-virus mixtures before addition to cell cultures and the activity of each sample of vaccine as the geometric mean titre produced by the group of monkeys.

Results

Fig. 1 gives the results of tests made with samples from all three batches before and after storage at 4° C. Taking into account the variation which is often encountered in the response of monkeys to poliomyelitis vaccine, there was no evidence, with any of the three batches, of a loss in antigenic activity during 12 months at this temperature; neither was there evidence of a loss with batch 4, which was stored for 21 months.

At higher temperatures of storage, however, a decline in potency was observed (Fig. 2). Although storage at 21° C. had no detectable effect on the activity of the type 2 and 3 components even after 100 days, this temperature considerably reduced the activity of the type 1 component after 40 days' storage and brought about a still further reduction after 100 days. At 31° C. the decline in activity was more striking. After storage for 40 days there was a considerable decline in the type 1 activity, less with the type 2, and none detectable with the type 3; after 100 days, however, the activity of all three types was completely lost.

Conclusions

The results of these tests indicate that poliomyelitis vaccine may be stored at 4° C. for at least 12 months

FIG. 2.—Effect of storage at 21° and 31° C.

without a detectable loss occurring in the antigenic activity of all of its three components. It is suggested that refrigeration at 0° C. to 10° C. would be equally suitable. At higher temperatures, such as 21° C. and 31° C., the activity is much less stable, especially in the case of the type 1 component.

It is important, therefore, that transportation of unrefrigerated vaccine in temperate climates should be carried out in as short a time as possible. Since considerable reduction in the activity of the type 1 component was found to occur after 40 days' storage at 21° C., it is suggested that vaccine should not be held unrefrigerated for periods longer than seven days.

It is also suggested, in view of the rapid loss in activity which was shown to occur at 31° C., that transportation of vaccine in tropical climates should not be carried out without refrigeration facilities.

We thank the Glaxo Laboratories and Eli Lilly and Company for the supply of poliomyelitis vaccine. We also thank Miss K. South and Miss P. Tumber for their technical assistance.

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Medical Memorandum

An Unusual Cause of Solitary Hepatic Abscess

Hepatic suppuration is an uncommon condition, and solitary hepatic abscess comprises a small proportion of this group. The following case of solitary hepatic abscess was of such unusual aetiology that it is recorded.

CASE REPORT

A man aged 34 was admitted from the casualty department on June 27, 1957, with a history of recurring attacks of epigastric pain in the previous six weeks. An attack had occurred on most days, lasting a variable number of hours; the pain was severe, sustained in its intensity, and radiated into the upper lumbar region. It had no relation to meals, activity, or personal habits, and it was not relieved by antacids or food. There had been no nausea or vomiting. His bowel habit was regular, and he had had no disturbance of micturition. A particularly severe attack of pain lasting six hours caused his admission to hospital.

On admission the patient was not in obvious pain; mouth temperature was 100.4° F. (38° C.). No abnormality was seen on inspection of the abdomen. Palpation revealed tenderness with guarding of the epigastrium and beneath the right costal margin. There were no physical signs elsewhere in the abdomen. The rest of the physical examination revealed no abnormalities; urinalysis was negative; Hb, 12.4 g./100 ml.; W.B.C. 15,000/c.mm. (neutrophils 70% and monocytes 10%).

A provisional diagnosis of "leaking" peptic ulcer was considered and a radiograph of the abdomen carried out to detect free air under the diaphragm. A gas shadow was not seen, but the antero-posterior film did reveal a sewing-needle lying to the right of the first and second lumbar vertebrae. The air-filled duodenal cap was seen below the needle, suggesting that the needle was outside the gastro-intestinal tract (see Fig.). On further questioning, the patient admitted that he had for several years swallowed objects, mainly needles, as a trick in public-houses; he stoutly denied that any harm had resulted from this pastime.

On the assumption that he had a perigastric abscess a laparotomy was performed (Mr. K. F. Wood). In fact, a

large tense fluctuant swelling (15 cm. in diameter) was found within the lobes of the liver. There were a few flimsy adhesions between the first part of the duodenum and the underside of the liver but without evidence of a perforation of the stomach or gut. Pus was obtained on aspiration of the swelling. The abscess was then excluded from the peritoneal cavity by packs and drained externally by a rubber tube. A needle 4.5 cm. long was found embedded in the wall of the abscess. Post-operatively the liver-function tests were normal and culture of the pus showed it to be sterile. The patient made an uneventful recovery and left the hospital on July 27.

Biopsy of abscess wall (Dr. O. G. Dodge) was reported to have the appearances of a non-specific subacute liver abscess.

Needle lying above gas shadow of duodenum.

COMMENT

Pyogenic abscesses of the liver are relatively uncommon. Ochsner, DeBakey, and Murray (1938) found 42 cases in half a million admissions during a 10-year period at the Charity Hospital in New Orleans. In these and other statistics (Rothenberg and Linder, 1934; Eliason *et al.*, 1938; Kisner, 1947; Yarvis, 1953) both multiple and solitary abscesses are grouped together, although it is clear that multiple lesions arising usually from appendiceal or gall-bladder infections greatly outnumber solitary ones.

Penetrating injuries from without occasionally result in a solitary hepatic abscess; there is, however, only one previous record (Morris, 1940) of the transperitoneal migration of a foreign body—in this case a toothpick—from the gastro-intestinal tract to the liver. As in the above case, there was no naked-eye evidence of perforation on the gut surface, although there was marked adherence of the colon, omentum, jejunum, and pancreas to the abscess site.

I thank Professor R. P. Jepson and Mr. K. F. Wood for their encouragement and help in writing this report.

ALAN K. YATES, M.B., Ch.B.,
Late House-surgeon, University Department of Surgery,
Royal Infirmary, Sheffield.

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