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Sporadic Occurrence of ECHO Virus Types 27 and 31 Associated with Aseptic Meningitis in Ontario

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ABSTRACT

The sporadic occurrence of ECHO virus types 27 and 31 in association with aseptic meningitis during the enterovirus seasons in Ontario in 1959 to 1962 is reported.

The etiological significance of both of these isolates was verified by demonstration of type-specific serological response in meningitis patients. ECHO 27, which up to now has not been encountered in association with human illness, could be added to the list of viral agents capable of causing aseptic meningitis. Isolation of ECHO 31 from cerebrospinal fluid provides definite proof of the etiological significance of this virus in cases of aseptic meningitis.

SOMMAIRE

Les auteurs rapportent l'apparition sporadique de virus ECHO des types 27 et 31, accompagnant des cas de méningite aseptique durant les saisons à entérovirus s'étalant de 1959 à 1962.

La signification étiologique de la découverte de ces deux virus a pu être confirmée par la positivité des réactions sérologiques spécifiques chez des malades souffrant de méningite. Le virus ECHO 27, qui n'avait pas été rencontré jusqu'ici en pathologie humaine, peut être ajouté à la liste des virus pathogènes de la méningite aseptique. L'isolement du virus ECHO 31 dans le liquide céphalo-rachidien a permis de démontrer clairement le rôle de ce virus dans l'étiologie des cas de méningite aseptique.

MENINGITIS is one of the commonest manifestations of ECHO virus infections. Only about one-third of the 32 recognized ECHO virus types has not yet been proved to have an etiological relationship with the disease.[1] One of these, ECHO 27, isolated originally from a rectal swab of a healthy person living in the Philippines,[2] has not yet been encountered in association with any human illness, as far as is known. On the other hand, ECHO 31, one of the four new serotypes added recently to the ECHO virus group,[3] has already been reported to occur in cases of meningitis, though so far only in the United States[4, 5] and Denmark.[6]

In the following communication, a brief report is given on the occurrence of ECHO types 27 and 31 in association with cases of aseptic meningitis in Ontario.

MATERIALS AND METHODS

Specimens submitted by physicians from patients residing in various localities of Ontario included stools, cerebrospinal fluids (CSF), nasal swabs, throat washings and blood samples. Primary monolayer cultures of trypsinized rhesus monkey kidney and human amnion cells and also continuous cell lines (HeLa and FL) were employed in parallel for inoculation with specimens. Identification of virus isolates and antibody assays were performed in monkey kidney cell cultures, using standard techniques. Antisera to the prototype strains of ECHO 27* and ECHO 31† viruses as well as to representative strains of groups of unclassified isolates were prepared in rabbits.

RESULTS

From specimens submitted during 1956 to 1962 a number of viral agents were isolated which could not be typed by reference antisera to the then recognized types of enteroviruses.[7, 8] Using immune rabbit sera prepared with selected, plaque-purified strains, several groups of unclassified viruses were established, each representing a different serotype. When the prototype strains of the higher numbered ECHO viruses became known, one group of isolates proved to belong to ECHO 27 and another to ECHO 31.

ECHO 27 strains were isolated from four and ECHO 31 from eight cases of aseptic meningitis. All the isolations were made from stool specimens with the exception of one ECHO 31 isolate which was recovered from CSF. All data pertinent to isolations are recorded in Table I.

Paired sera were available only from two patients. In one case, from which ECHO 27 was isolated, the acute phase serum collected four days after onset contained no antibodies to the isolate, whereas the convalescent phase serum obtained three weeks later had a titre of 1:16. In the second

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*Obtained from the American Type Culture Collection.
†Received through the courtesy of Dr. J. L. Melnick, Houston, Texas.

TABLE I.—DATA ON THE ORIGIN OF VIRUS ISOLATIONS

Patients						*Homotypic titre*	
Initials	*Sex and age*	*Residence (Ontario)*	*Specimens*	*Virus isolation*	*Date of onset*	*Acute*	*Convalescent*
B.D.	M 27	Elliot Lake	Stool No. 1 Stool No. 2 Stool No. 3	ECHO 27 (3) ECHO 27 (4) ECHO 27 (5)	July 14/61	0 (3)	*
K.B.	F 17	Sudbury	Stool	ECHO 27 (2)	Sept. 18/61	0 (3)	*
S.R.	M 2	Ottawa	Stool No. 1	ECHO 27 (4)	Sept. 23/61	0 (4)	*
G.A.	M 33	Peterborough	Stool	ECHO 27 (10)	Oct. 6/62	0 (4)	1:16 (25)
B.E.	M 30	Fergus	Stool	ECHO 31 (11)	July 15/60	0 (?)	*
W.G.	M 31	Toronto	Stool	ECHO 31 (5)	Aug. 17/60	*	*
H.C.	F 3	St. Catharines	Stool	ECHO 31 (8)	Aug. 17/60	*	*
L.K.	M 8	Fort William	Stool No. 1 Stool No. 2 CSF	ECHO 31 (3) ECHO 31 (10) ECHO 31 (3)	Aug. 21/60	0 (3)	*
S.D.	M 19	Dryden	Stool	ECHO 31 (7)	Aug. 22/60	0 (7)	1:8 (10)
N.R.	M 25	London	Stool	ECHO 31 (?)	Sept. ?/59	*	*
K.I.	F 21	Toronto	Stool	ECHO 31 (2)	Oct. 1/61	0 (2)	*
E.R.	M 5	Port Arthur	Stool	ECHO 31 (?)	Sept. 2/60	*	1:16 (12)

Note: Figures in parentheses indicate number of days from onset of illness till collection of specimens.
0 = negative in the starting dilution of 1:4.
* = not available for testing.

patient, whose stool specimen yielded ECHO 31, the first serum specimen collected seven days after the onset of his illness contained no detectable antibodies, but a second serum specimen obtained three days later, i.e. 10 days after the onset of his illness, had a titre of 1:8. In one case a convalescent serum sample only was available for testing and it had a titre of 1:16 to the ECHO 31 isolate. From six additional patients acute phase blood specimens only were submitted; these were all free of antibodies to the virus type isolated.

TABLE II.—RESULTS OF SEROLOGICAL SURVEY ON PAIRED SERA FROM MENINGITIS PATIENTS NOT YIELDING VIRUS

	No. of serologically positive cases, 1960 - 1961				*No. of serologically positive cases, 1963*		
Virus type	*No. of paired sera tested*	*4-fold increase in titre*	*Stationary titres 1:8 - 1:128*	*Total*	*No. of paired sera tested*	*Increase in titre*	*Stationary titres 1:8 - 1:32*
ECHO 27	130	4	6	10 (7.7%)	30	0	0
ECHO 31	130	5	16	21 (16.2%)	30	0	0

In a serological survey (Table II) conducted on sera of 130 patients who had meningitis during the enterovirus season in 1960 and 1961, but from whom no virus was isolated, the presence of antibodies to ECHO 27 was demonstrated in 10 (7.7%) and to ECHO 31 in 21 (16.2%) of the cases. Nine patients showed a four-fold or greater increase in titre to either ECHO 27 or ECHO 31 in the convalescent phase as compared with the acute phase. In the remaining 22 cases, type-specific antibodies were detected in titres of 1:8 to 1:128 at stationary levels.

In 30 paired sera selected at random from aseptic meningitis cases occurring in 1963, when neither ECHO 27 nor ECHO 31 was found to occur in the province, no antibodies to ECHO 27 could be detected. The presence of antibodies to ECHO 31 was demonstrated in three of these cases, but only in stationary low titres of 1:8 to 1:32.

COMMENTS

Isolation of an enteric virus from stool specimens alone, without confirmation of serological response, does not necessarily indicate a causative relationship between a particular isolate and the illness, as the presence of the virus in the alimentary tract may simply be due to a carrier state. Isolation of an enteric virus from body fluids (CSF, blood) or tissues (brain, spinal cord, lung, etc.), of course, provides unequivocal proof of the etiological significance of the isolate.

In the cases reported here, ECHO 27 was isolated from stool specimens only. However, demonstration of serological response to ECHO 27 in at least one virus excretor and in about 8% of meningitis cases, from whom no virus was recovered, provides strong suggestive evidence as to the etiological role of ECHO 27 in aseptic meningitis, which up to now was not encountered in association with human illness.

Isolation of ECHO 31 from cases of aseptic meningitis, on the other hand, should be interpreted as of definite etiological significance, since the virus was

found not only in fecal samples but also in the CSF, and the significance of isolations was further confirmed by demonstration of serological response. In addition, the presence of antibodies to ECHO 31 in sera of about 16% of meningitis cases, from whom no virus was isolated, should be considered as further evidence of the etiological role of ECHO 31 in cases of meningitis.

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SPECIAL REPORT

A Russian Bioelectric-Controlled Prosthesis:

Report of a Research Team from the Rehabilitation Institute of Montreal

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FOLLOWING the publicity in the medical and lay press concerning a revolutionary artificial arm designed and developed in Russia, an investigation team sponsored by the Research and Training Unit of the Rehabilitation Institute of Montreal visited the United Kingdom and the U.S.S.R. from July 11 to 23 to obtain further information about this device. The official arrangements for the visit were made by the Department of National Health and Welfare, acting in concert with the Ministry of External Affairs who consented to implement this request by action through the appropriate diplomatic channels. The Rehabilitation Institute of Montreal is indebted to the Canadian Government for its efforts which helped to ensure the success of this mission.

This group was headed by Dr. G. Gingras, Executive Director, and included Dr. M. Mongeau, Chief of Service, Physical Medicine and Rehabilitation, Mr. A. Lippay, Consultant Engineer, and Mr. C. Corriveau, Consultant Prosthetist, all of the Rehabilitation Institute of Montreal.

During a brief stay in the United Kingdom the group met with Lady Hoare, Chairman of the British Trust Fund for Thalidomide Children, and with Sir Reginald Watson-Jones, both of whom had travelled recently to the U.S.S.R. to inspect the new bioelectric artificial limb developed by the Central Prosthetic Research Institute of the U.S.S.R.

As had been reported in the press, the Lady Hoare Trust Fund, through the contribution of an anonymous benefactor, recently purchased the rights to manufacture this Russian prosthesis in the United Kingdom.

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The Russians claim that some 125 patients are using the appliance successfully; this number includes double upper arm amputees. Prototypes of the arm were inspected and demonstrations were given, both in Roehampton, at the National Prosthetic Centre of the United Kingdom, and at the Central Prosthetic Research Institute of the U.S.S.R. in Moscow.

DESCRIPTION OF THE RUSSIAN ARTIFICIAL ARM WITH MYOELECTRIC CONTROL (Fig. 1)

Engineering Principles

The externally powered active component of this device is the hand, which houses the drive motor in the metacarpal area and produces a single movement of simple pinch or grasp with a maximum force of 15 kg. available at the fingertips. A detailed analysis of the motor could not be made but, according to the British group, it contains an integral gear reduction and a worm gear drive. The motor operates at a high speed with an acceptable noise level, and the small size of the battery which provides the power indicates that this type of motor is a very efficient energy converter. This development is probably a by-product of space navigational research.

Control is effected by myoelectric signals picked up by twin electrodes placed in contact with muscles selected for this purpose. The signals are magnified by a miniature transistorized amplifier, which in turn drives an electronic gating unit or relay to control the motor. The motor then runs in the desired direction to open or close the hand, stopping when the signal is discontinued. The position of the hand is then mechanically held until a reverse signal is received by the amplifier. Should