ISSN 0725-3141

Communicable Diseases Intelligence

Bulletin number 83/4
Issue date: 25 February 1983

Contents:

. Primary Amoebic Meningoencephalitis

VIRUS REPORTING SCHEME

A total of 1000 reports were received during this period. In the last issue comment was made on the paucity of Ross River virus notifications received so far this year compared to the same period last year. In this issue eleven additional notifications of Ross River virus infections have been received from Western Australia and Queensland.

- Echovirus 11 isolates, previously reported (CDI 82/17) from W.A. in young children, have now been identified from South Australia, Victoria, N.S.W. and Queensland. Of the seven Melbourne cases, five isolates were from the Royal Childrens Hospital in children aged less than three years, two of whom presented as meningitis and one with convulsions. One of the two isolates from Fairfield hospital was from a male neonate aged six days with meningitis. Ten of the reports from Queensland, were under six months of age. In these infants the most frequent presenting sydrome was meningitis and one neonatal child died. Echovirus 11 is still being identified from W.A. with three of the isolates being in children under one year of age.

- Rubella virus continues to be isolated from pregnant patients. At Fairfield hospital, of six females from whom rubella was isolated, four were from country hospitals and two were from the metropolitan area. One of these two had no rash but IgM was identified by haemagglutination inhibition test and the person is now 20 weeks pregnant.

The Bulletin is compiled and distributed by the Environmental Health Branch, Department of Health,
P.O. Box 100, Woden, A.C.T. 2606, Australia, and is available on request.
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PRIMARY AMOEBIC MENINGOENCEPHALITIS
(Based on "Primary Amoebic Meningoencephalitis - An historical and epidemiological perspective with particular reference to South Australia" contributed by M.M. Dorsch, South Australian Health Commission).

References have been made to Naegleria fowleri infection in CDI 80/3, 80/4, 81/2, 81/17. Margaret Dorsch's article now gives a survey of cases from 1955-1981, with particular references to cases since 1965 when it was recognised as a clinical entity.

Primary amoebic meningoencephalitis (PAM) is a rare but rapidly fatal infection of the meninges and brain caused by the amoeba, N. fowleri. It was first recognised as a clinicopathological entity by the Adelaide Children's Hospital pathologist, Dr Malcolm Fowler, in 1961. However, publication of his initial observations on a patient from Port Augusta was delayed until a further three cases had occurred. Hence, a scientific account of the condition popularly known as "amoebic meningitis" did not appear in the medical literature until September, 1965. In this first account of the disease, Fowler and Carter [1] described in detail four cases that had occurred in the Spencer Gulf region of South Australia between 1961 and 1965.

As knowledge of PAM increased from 1965, there was a surge of interest in finding the environmental sources of the human infections. However, the isolation of N. fowleri from the physical environment proved to be more difficult than expected. Because virtually all the reported cases of PAM, with the notable exception of those in South Australia, had been associated with swimming in freshwater, investigations were largely concentrated on pools or natural lakes [2]. Because it was also thought at first that infection could occur as the result of the inhalation of dust harbouring amoebic cysts [3], numerous soil and dust samples were examined in attempts to isolate the organism from the environment. In their first account of PAM, Fowler and Carter had already expressed the view that the most likely route of infection was via the olfactory lining and nerves. This view was subsequently confirmed by post mortem examinations and by experimental infections in other species [4]. There has since been no evidence to suggest that infection can occur by any route other than this olfactory pathway, or by inhalation of dust-borne cysts of N. fowleri despite an isolated claim to the contrary [5].

The first isolation of the pathogen from the physical environment was another South Australian achievement. In March 1972, it was reported in the local press that Dr Kevin Anderson and Miss Adele Jamieson of the Amoebic Research Unit (Institute of Medical and Veterinary Science,

Adelaide) had isolated the pathogenic amoeba in water from a backyard tap. Their finding was subsequently published [6].

Since then, N. fowleri has been isolated from many other damp soil and freshwater habitats in Australia and overseas. These include sewers, natural lakes, swimming pools and thermally polluted discharge waters from industrial plants [7].

For many years the observed clustering of South Australian cases in the Spencer Gulf region defied explanation. Moreover, the fact that nearly half these victims had not been swimming in freshwater in the week before their illness was a unique and puzzling feature of PAM's epidemiology. (A history of recent swimming in freshwater had been the epidemiological link between all overseas victims of the disease.) This apparent anomaly was not finally solved until Anderson and Jamieson demonstrated the pathogen in water sampled from a backyard tap at the house of one of the Port Augusta victims in March, 1972.

Suspicions that the Morgan-Whyalla pipeline might be implicated in the incidence of PAM began to grow when it was discovered in retrospect that one of the Kadina victims, who had no history of swimming had, nevertheless, been repeatedly ducking her head in a school water trough during the heat wave conditions immediately preceding her illness (personal communication from Dr Fleet, LMO, Kadina to the late Dr K. Anderson, IMVS, 1971). Water at the school was derived from a branch of the pipeline.

By this time PAM was well known as the "summer killer" and it seemed logical to take a closer look at the reticulated supply. Branches 1 and 2 of this pipeline extend overland for approximately 359 and 283 kilometres, respectively. The first branch was completed in 1944 and runs aboveground for virtually its entire length. Branch 2 was completed in 1966, and differs from the first in that it runs for 12 kilometres under the sea at Spencer Gulf between Port Augusta and Whyalla. Most of the time much of the City of Whyalla's domestic water is derived from this latter branch. However, depending on local demand and other engineering factors, water from Branch 1 can also be fed into the local distribution system in larger quantities as required.

After its traverse across some of the hottest, driest country on the continent, water temperatures in this pipeline during summer can be extraordinarily high. The maximum water temperature so far recorded in the Morgan-Whyalla distribution network was 49°C, at the Causeway, Port Augusta, in January, 1982. Residents in the so-called "Iron Triangle" towns can take a hot shower in summer without heating water for this purpose.

Results of the Engineering and Water Supply Department's amoeba monitoring programme have clearly indicated that *Naegleria* species, including *N. fowleri*, can and do exist in the Morgan-Whyalla and other South Australian pipelines. Fortunately, both the cysts and trophozoites of *N. fowleri* are susceptible to relatively low doses of chlorine. Experimental work has demonstrated that a 0.5 mg/L free chlorine residual (at pH7) is sufficient to kill 99% of these organisms in water, provided that contact time is 30 minutes or more [8]. In the field, longer contact times may be required to compensate for variations in pH and temperature [9].

Filtration offers other benefits. For example, large reductions in the organic load of filtered water would lead to lower chlorine dosages being needed to achieve residual levels sufficient to destroy *N. fowleri*, and to a lower potential for formation of trihalomethanes.

Up to November, 1981, there have been 19 confirmed or strongly suspected cases of PAM recorded in Australia. Of these, 14 have occurred in South Australia (the diagnosis in two cases is not confirmed), three in Western Australia, and one each in Queensland and New South Wales. With the exception of the Queensland case, all Australian victims of PAM have died, even when the disease has been recognized relatively early and treated with amphotericin B. It is possible that the actual number of Australian cases is greater than 19 because of misdiagnosis in earlier years.

Between February 1972 and January 1981 (i.e., a period of nine years) there were no PAM victims in South Australia, whereas prior to the discovery of *N. fowleri* in the Morgan-Whyalla pipeline with consequent booster chlorination from the summer of 1972/73, there had been sporadic cases at frequent intervals.

Interestingly, the circumstances surrounding at least two of the Western Australian cases parallel the situation here in South Australia. The inland towns of Merredin and Beverley both obtain water via the overland pipelines of the Goldfields and Agricultural Water Supply Scheme, originating from Mundaring Weir [10]. There are open storage tanks and earth-floored reservoirs at various points along this distribution system which may allow amoebae access to town water supplies. A similar situation prevails in many of the reticulation systems derived from the Morgan-Whyalla pipeline, particularly within the Yorke Peninsula system.

During January, 1980, the southwest of Western Australia experienced a prolonged heat wave, conditions which were conducive to the proliferation of *N. fowleri* in water supplies. It was reported that the children affected by PAM in that year had both been swimming frequently in pools prior to their illness [11]. Isolates of *Naegleria* species were made

from the mains supply to the Beverley swimming pool, and from the backwash of the pool filter. However, no amoebae of the genus Naegleria were found in water samples collected at Merredin soon after the outbreak.

The New South Wales victim also had a history of recent swimming in a private open air pool at Richmond near Sydney[12]. Water samples taken from this pool and also from the Nepean River one month after the victim's death yielded some non-pathogenic Naegleria species, but no N. fowleri.

Apparently, outbreaks of PAM are dependent upon seasonal factors because all cases have occurred in the summer months, between October and March. Most of the Australian cases have been associated with heat wave conditions. Current evidence and experience suggest that the summer months constitute a period of high risk for PAM because:

(1) water-related activities are more frequent/prolonged at this time; and
(2) summer water conditions favour growth and multiplication of the pathogen.

As the prognosis of PAM is so poor despite amphotericin B (only two or possibly three victims are known to have survived), efforts to control the disease have been directed largely towards prevention.

Australia is unique in that public water supplies (piped overland) may have been the ultimate source of the pathogen in most cases. A major thrust of preventive action here has been educating the public about the dangers of allowing potentially contaminated water to enter the nose. This is particularly true of South Australia which has the highest recorded incidence in the country (14 out of a total of 19 cases). In contrast, overseas cases have been associated with swimming in natural lakes, thermally polluted streams, hot springs or heated indoor pools, none of which is common in the Australian environment. The official response to outbreaks of PAM in other countries has generally been to warn swimmers of the danger and/or to close the affected waters to the public. Banner headlines and exaggerated media coverage of PAM have been a feature of some American cases, just as they have been for virtually all South Australian victims since 1971.

One aspect of PAM which has not been given adequate emphasis in South Australia, especially by the media, is that it is a very rare disease. Furthermore, although supplementary chlorination of water supplies has been, and is, extremely effective in controlling the amoeba, it is impossible to guarantee its absence in all water supplies at all times. This conclusion is reached after consideration of engineering and related physical aspects of water distribution in northern areas of this State, in addition to economic factors. It should be realized that

individuals themselves must take a personal responsibility for minimizing the risks of infection. With this in mind, it is appropriate to review the history of the public education campaigns relating to amoebic meningitis in South Australia.

The first public information pamphlets on PAM were introduced in South Australia in November, 1972, following the demonstrated association between a case of the disease in Port Augusta and the public water supply. By that time the disease was sufficiently understood to make the distribution of such material appropriate. The publicity programme has been continued ever since, with most emphasis concentrated in the areas known to be at risk of the disease. Its basis was:
(1) avoidance of water entry into the nose;
(2) the proper maintenance of swimming and paddling pools, whether they be privately or publicly owned; and
(3) the avoidance of personal behaviour patterns, e.g. head ducking in baths or splashing under the shower, which could increase the risk of infection.

Over the years, these basic messages have remained substantively unaltered, although there have been a few changes of emphasis and deletions of advice no longer considered correct or appropriate.

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AUSTRALIA - COMMUNICABLE DISEASES INTELLIGENCE

REPORTING PERIOD - 3/2/83 - 16/2/83 BULLETIN NUMBER 83/4

VIRAL IDENTIFICATIONS FROM CONTRIBUTING LABORATORIES

VIRUS OR VIRAL ANTIGEN	ICPMR (NSW)/ WVH (ACT)	RAHC (NSW)	PHH/ POW (NSW)	FAIR-FIELD (VIC)	RCH (VIC)	IMVS (SA)	STATE LAB (QLD)	STATE LAB (WA)	Total
0100 ADENOVIRUS NOT TYPED..................	2					1	4	3	10
0101 ADENOVIRUS TYPE 1.................					1	6			7
0102 ADENOVIRUS TYPE 2.................				1	3	3		1	8
0103 ADENOVIRUS TYPE 3.................								1	1
0104 ADENOVIRUS TYPE 4.................								1	1
0105 ADENOVIRUS TYPE 5.................					1	4			5
0108 ADENOVIRUS TYPE 8.................								1	1
0119 ADENOVIRUS TYPE 19................								3	3
0199 ADENOVIRUS TYPING PENDING..........			3		4	1			8
0201 INFLUENZA A VIRUS.................			1				4	2	7
0202 INFLUENZA A VIRUS SUBTYPE H3N2.....					2				2
0203 INFLUENZA B VIRUS.................			3					2	5
0302 PARAINFLUENZA VIRUS TYPE 2.........					1	1		1	3
0303 PARAINFLUENZA VIRUS TYPE 3.........	1			1	6	4			12
0399 PARAINFLUENZA VIRUS TYPING PENDING.						1			1
0400 RESPIRATORY SYNCYTIAL VIRUS (RS)...	1						4	2	7
0500 RHINOVIRUS (ALL TYPES)............				1	10	1	5		17
0600 MYCOPLASMA PNEUMONIAE..............	6		4	1		2	12	8	33
0700 ORNITHOSIS-PSITTACOSIS.............				1					1
0800 COXSACKIEVIRUSES GROUP A - NOT TYPED.................								1	1
0816 COXSACKIEVIRUS A16.................				3					3
0899 COXSACKIEVIRUS GROUP A TYPING PENDING.................							1		1
0901 COXSACKIEVIRUS B1..................					4				4
0902 COXSACKIEVIRUS B2..................	1								1
0903 COXSACKIEVIRUS B3..................	3	2	3		2	1	1	1	13
0904 COXSACKIEVIRUS B4..................						1		1	2
0905 COXSACKIEVIRUS B5..................						1	1	2	4
1003 ECHOVIRUS TYPE 3...................	1							1	2
1005 ECHOVIRUS TYPE 5...................	1								1
1009 ECHOVIRUS TYPE 9...................						1			1
1011 ECHOVIRUS TYPE 11..................	5	1	8	2	5	3	13	6	43
1012 ECHOVIRUS TYPE 12..................		1							1
1013 ECHOVIRUS TYPE 13..................								2	2
1022 ECHOVIRUS TYPE 22..................	1		2				1		4
1030 ECHOVIRUS TYPE 30..................					3				3
1099 ECHOVIRUS TYPING PENDING...........				2			3		5
1100 POLIOVIRUS NOT TYPED...............						1			1
1101 POLIOVIRUS TYPE 1..................			4					1	5
1102 POLIOVIRUS TYPE 2..................	1								1
1103 POLIOVIRUS TYPE 3..................								2	2
1104 POLIOVIRUS-VACCINAL STRAIN.........					1				1
1200 MUMPS VIRUS........................	3			4			4	4	15
1300 HERPES VIRUS GROUP-NOT TYPED.......	15		1	4		4			24
1301 HERPES SIMPLEX VIRUS NOT-TYPED.....				2				51	53
1302 EPSTEIN-BARR VIRUS (EB VIRUS)......	6							5	11
1303 VARICELLA-ZOSTER VIRUS.............		1	1	1			2	1	6
1306 HERPES SIMPLEX TYPE 1..............	9			26		17	22		74
1307 HERPES SIMPLEX TYPE 2..............	87		2	41		22	53	2	207
1399 HERPES VIRUS TYPING PENDING........			8		1	4			13
1401 COXIELLA BURNETI...................	3			1			6		10
1502 PICORNA VIRUS-NOT TYPED............	1		5					4	10
1514 MOLLUSCUM CONTAGIOSUM..............								1	1
1521 MEASLES VIRUS......................	1			4	1	1			7
1522 RUBELLA VIRUS......................			2	10	1	1	3	4	21
1531 HEPATITIS B VIRUS..................				1					1
1532 HEPATITIS B ANTIGEN................	21		10	35	1	13	5	6	91
1535 HEPATITIS A ANTIBODY...............	2					6	4	22	34
1541 CHLAMYDIA A - C TRACHOMATIS........	19		4			3		89	115
1556 CMV - CYTOMEGALOVIRUS..............	5		1	13	10	6	3		38
1564 ROTAVIRUS..........................		5	1	2		2			10
1599 ENTEROVIRUS TYPING PENDING.........			6		4		1		11
ROSS RIVER VIRUS							7	5	12
SMALL VIRUS (LIKE) PARTICLE	1					2			3
Total...................................	196	10	69	156	61	113	159	236	1,000

AUSTRALIA - COMMUNICABLE DISEASES INTELLIGENCE

PERIOD : 3,2,83 to 16,2,83 .... 83/4

Viral Identifications by Clinical Information Table 1.
Code 00,99 -No ill or data; 01,02,11,12 -Respiratory; E3 -Encephalitis; M3 -Meningitis; 04 -Paralysis; 05,13 -CNS other unspec.; 07,49 -GI; 17,47 -Hepatic; 19 -CVS; 89 -Urinary; 06 -Skin/mucous.

VIRUS OR VIRAL ANTIGEN	No-ill or data	Respiratory	Encephalitis	Meningitis	Paralysis	CNS other unspec	GI	Hepa-tic	CVS	Urin-ary	Skin/ mucs memb
0100 ADENOVIRUS NOT TYPED..........		2					5				
0101 ADENOVIRUS TYPE 1.............		3					2				
0102 ADENOVIRUS TYPE 2.............		6					1				1
0103 ADENOVIRUS TYPE 3.............		1									
0105 ADENOVIRUS TYPE 5.............		1					4				
0201 INFLUENZA A VIRUS.............	1	5						1			
0202 INFLUENZA A VIRUS SUBTYPE H3N2		2									
0203 INFLUENZA B VIRUS.............	1	3									
0302 PARAINFLUENZA VIRUS TYPE 2....		3									
0303 PARAINFLUENZA VIRUS TYPE 3....		11									
0400 RESPIRATORY SYNCYTIAL VIRUS (RS)..........................		7							1		
0500 RHINOVIRUS (ALL TYPES)........	1	14				1					
0600 MYCOPLASMA PNEUMONIAE.........	5	23		1					1		
0700 ORNITHOSIS-PSITTACOSIS........		1									
0800 COXSACKIEVIRUSES GROUP A - NOT TYPED.........................											1
0816 COXSACKIEVIRUS A16............				1							2
0899 COXSACKIEVIRUS GROUP A TYPING PENDING.........................											1
0901 COXSACKIEVIRUS B1.............		2				1			1		
0902 COXSACKIEVIRUS B2.............	1										
0903 COXSACKIEVIRUS B3.............	3	2		1			3				
0904 COXSACKIEVIRUS B4.............							1				
0905 COXSACKIEVIRUS B5.............				1			2				
1003 ECHOVIRUS TYPE 3..............			1								1
1005 ECHOVIRUS TYPE 5..............				1							
1009 ECHOVIRUS TYPE 9..............		1									
1011 ECHOVIRUS TYPE 11.............	5	1		20		2	8		1		
1012 ECHOVIRUS TYPE 12.............		1									
1022 ECHOVIRUS TYPE 22.............		1					3				
1030 ECHOVIRUS TYPE 30.............			1			1	1				
1100 POLIOVIRUS NOT TYPED..........							1				
1101 POLIOVIRUS TYPE 1.............							5				
1103 POLIOVIRUS TYPE 3.............	1										
1104 POLIOVIRUS-VACCINAL STRAIN....		1					1				
1200 MUMPS VIRUS...................				2				1			
1300 HERPES VIRUS GROUP-NOT TYPED..											19
1301 HERPES SIMPLEX VIRUS NOT-TYPED	1		1		1						3
1302 EPSTEIN-BARR VIRUS (EB VIRUS).	2							2			
1303 VARICELLA-ZOSTER VIRUS........	1		1								4
1306 HERPES SIMPLEX TYPE 1.........	1	3	1	1		1				1	34
1307 HERPES SIMPLEX TYPE 2.........	4										18
1401 COXIELLA BURNETI..............	1						1				
1502 PICORNA VIRUS-NOT TYPED.......		1		1		1					2
1514 MOLLUSCUM CONTAGIOSUM.........											1
1521 MEASLES VIRUS.................		1	1			1					4
1522 RUBELLA VIRUS.................	3	1									15
1531 HEPATITIS B VIRUS.............											1
1532 HEPATITIS B ANTIGEN...........	29						1	49			
1535 HEPATITIS A ANTIBODY..........	10						2	19			
1556 CMV - CYTOMEGALOVIRUS.........	7	12			1		1	1		3	1
1564 ROTAVIRUS.....................							10				
9992 ROSS RIVER VIRUS..............		1									7
9994 SMALL VIRUS (LIKE) PARTICLE...							2				
Total..............................	77	110	6	29	2	8	54	73	4	4	146

AUSTRALIA - COMMUNICABLE DISEASES INTELLIGENCE

PERIOD : 3/2/83 to 16/2/83 ... 83/4

Viral Identifications by Clinical Information Table 2.
Code 10 -Eye; 59 -Genital; 39 -Endo/sal gland;
38 -RES; 29 -Muscle/joint; 69 -Congenital; P8 -PUO;
G8 -Fever/malaise; 09 -Other; A1 -SIDS ...

VIRUS OR VIRAL ANTIGEN	Eye	Genital	Endo/sal gland	RES	Muscle/joint	Congenital	PUO	Fever/malaise	Other	SIDS
0100 ADENOVIRUS NOT TYPED.........	3									
0101 ADENOVIRUS TYPE 1............							1			
0102 ADENOVIRUS TYPE 2............	1									
0104 ADENOVIRUS TYPE 4............		1								
0108 ADENOVIRUS TYPE 8............	1									
0119 ADENOVIRUS TYPE 19...........	1	3								
0201 INFLUENZA A VIRUS............								3		
0203 INFLUENZA B VIRUS............									1	
0303 PARAINFLUENZA VIRUS TYPE 3....							1			
0500 RHINOVIRUS (ALL TYPES)........								2		
0600 MYCOPLASMA PNEUMONIAE.........							1	12		
0901 COXSACKIEVIRUS B1.............									1	
0903 COXSACKIEVIRUS B3.............							1	3	1	
0904 COXSACKIEVIRUS B4.............								1		
0905 COXSACKIEVIRUS B5.............							1			
1011 ECHOVIRUS TYPE 11.............							1	6		
1013 ECHOVIRUS TYPE 13.............						1				
1022 ECHOVIRUS TYPE 22.............								1		
1030 ECHOVIRUS TYPE 30.............								1		
1102 POLIOVIRUS TYPE 2.............										1
1103 POLIOVIRUS TYPE 3.............								1		
1200 MUMPS VIRUS...................			9	1				3	1	
1301 HERPES SIMPLEX VIRUS NOT-TYPED		16								
1302 EPSTEIN-BARR VIRUS (EB VIRUS).			4	1			2	1	1	
1303 VARICELLA-ZOSTER VIRUS........								1		
1306 HERPES SIMPLEX TYPE 1.........	4	28						1		
1307 HERPES SIMPLEX TYPE 2.........	1	185								
1401 COXIELLA BURNETI..............								7	2	
1521 MEASLES VIRUS.................						1				
1522 RUBELLA VIRUS.................					1			4	1	
1532 HEPATITIS B ANTIGEN...........		2							10	
1535 HEPATITIS A ANTIBODY..........									3	
1541 CHLAMYDIA A - C.TRACHOMATIS...	2	92							2	
1556 CMV - CYTOMEGALOVIRUS.........		2				5	1	3	3	
1564 ROTAVIRUS.....................								1		
9992 ROSS RIVER VIRUS..............				1	6			6		
Total..............................	13	329	13	3	7	7	9	57	26	1