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Meningococcal Meningitis in the Taiwan Area in 1995 and 1996

Introduction

Neisseria meningitidis is the pathogenic agent of meningococcal meningitis. In 1884, Marchiatava and Celli found for the first time the bacteria in the meningeal discharges. In 1887, succeeded in cultivating the bacteria from the cerebrospinal fluids of six patients, Weichselbraum reported in detail the characteristics of the bacteria. This finding was confirmed by Jaeger in 1895 and subsequently by many others. The fact that *Neisseria meningitidis* was the pathogenic agent of meningococcal meningitis was thus established [(1)].

Neisseria meningitidis is a gram-negative coccus in 13 serotypes (A,B,C,D,H,I,K,L,X,Y,Z,29E,W-135) primarily by its polysaccharide capsule. Group A organisms have caused the major epidemics worldwide; group B and group C generally produce sporadic cases. Other serotypes such as W-135, X, Y and Z, weaker in virulence, have been identified recent1y [(2)].

The World Health Organization announced in July 1996 that since the beginning of the year, there had been several epidemic outbreaks of meningococcal meningitis in the central part of Africa; and that by the end of July, an estimated 15,000 people had died of meningococcal meningitis [(3)]. Since the beginning of this year, some 140,000 cases of meningococcal meningitis have been reported in the entire African continent; the highest number of cases ever reported in a single year in the African history. More than 95% of these reported cases were found to concentrate in the so- called ‘meningeal belt’ ranging from Ethiopia in the east through the central part of Africa to Senegal in the west [(3)].

In the Taiwan Area in the periods between 1919 and 1926, and 1933 and 1946, there were on average 300 cases of meningococcal meningitis reported each year, with as many as 600 cases in 1940. No outbreaks occurred thereafter, and the number of cases had also declined. In the last 20 years, with the exception of 8 cases reported in 1993, the number of cases per year had remained at about 5. However, the number

of cases went up to 9 and 14 respectively in 1995 and 1996 as Table 1[4].

At the time of epidemics in Europe and Africa, this analysis of the positive cases of meningococcal meningitis in the Taiwan Area in 1995 and 1996 was made.

Table 1. Cases and Deaths of Meningococcal Meningitis by Year, Taiwan Area

Year	No. of Cases	No. of Deaths
1912-1921	595	331
1922-1931	1,601	1,006
1932-1941	2,413	1,277
1942-1951	541	171
1952-1961	374	92
1962-1971	82	25
1972-1981	17	10
1982-1991	9	0
1992	5	0
1993	8	2
1994	4	0
1995	9	2
1996	14	0

Source: compiled from DOH Health and Vital Statistics, ROC, 1991, 1992, 1993, 1994, 1995.

Materials and Method

1. Collection and transportation of specimens

Generally, blood specimens are used for culture; spinal fluids, for microscopic examination, culture and biochemical testings; nasopharyngeal swabs, for the examination of carriers; and, discharges from punctured petechiae, for smear culture. As meningococci are highly susceptible to temperature changes, specimens should not be transported under cold temperature and should be sent immediately to laboratories. The National Institute of Preventive Medicine of the Department of Health (NIPM, DOH) often receives specimens transported in cold temperature. The organisms cannot be isolated as they will have died by the time the specimens reach the Institute. Institutions concerned, therefore, are urged not to transport in cold temperature either specimens of meningococcal meningitis or suspected strains isolated by hospitals [5].

2. Preparation, staining and observation of smears

Smears on glass slides were made from centrifuged spinal fluids or sediments of petechiae extractives. The smears were then dried and fixed with fire for gram-staining. The organisms are gram-negative, in bean shape in two rows, and each with a diameter of 0.6-0.8 um. The typical *Neisseria* bacteria would appear either inside or outside the polymorphonuclear leukocytes [(6)].

3. Cultivation of cerebrospinal fluids (CSF)

Suspensions of the centrifuged fluids were collected and placed on blood plates and chocolate agar. They were then placed in an incubator with 3-10% CO_2 for cultivation under 35 to 37℃. Humidity should be maintained at 50% and above [(7)].

4. Cultivation of nasopharyngeal discharges

Specimens were collected with sterile cotton-swabs and inoculated respectively on blood plates, chocolate agar and selective media under similar conditions as above [(7)].

5. Cultivation of blood

Blood specimens were placed in the blood culture flasks. If the flask contained SPS (0.02-0.05%), to prevent the organisms from being inhibited, 1 % gelatin was added7.

The improved Thayer-Martin agar contains several antibiotics (VCN, vancomycin, colistin and nystatin). Of these antibiotics, vancomycin can inhibit the gram-positive pollutive organisms; colistin can inhibit the normal colonies of gram-negative organisms; and nystatin can inhibit the growth of fungi. Pure cultures can be obtained from rectal and nasopharyngeal swabs if they are isolated initially with this T-M agar. This is an indispensable medium in the laboratory testings for meningococci carriers8. Pure cultures can generally be obtained from spinal fluids or blood. They can be further assayed with carbohydrate fermentation and type-specific (or polyvalent) serum agglutination test.

6. Form of colonies

After 18-24 hours of cultivation, the colony developed to a diameter of about 1 mm. It was protruding, smooth and glossy, in round shape and either colorless or milky grey. If the cultures were not pure or the cultivation process lasted for more than 36 hours, subculture should be done [(7)].

7. Oxidase test

On the tablet or paper of oxidase reaction substrates already moisturized with drops of saline solution, the organisms were placed. In 2-5 minutes, the reaction was positive if the tablet or paper turned into blue; and negative, if colorless [7].

8. Fermentation of carbohydrate

Some of the oxidase test positive colonies were placed in saline solution till the concentration was that of McFarland No 2. Some 0.25 mL of the solutions were placed in sterile test tubes and added differential carbohydrate tablets. The solutions were shaken for several times and then placed in incubator for cultivation at 35-37¢XC for 4-18 hours for observation of reactions. The result should be: glucose (+), maltose (+), lactose (—) and sucrose (—)[7].

9. Identification of serotypes

On a clean glass plate, one drop each of the bacterial suspension and the antiserum was added and mixed. In two minutes, the reaction was positive if agglutination particles appeared. Polyvalent antiserum was used for initial screening; and monovalent antiserum for confirmation [7].

Results and Discussion

1. No. of Confirmed Meningococcal Meningitis Cases in the Taiwan Area in 1995 and 1996

Of the reported meningococcal meningitis cases in 1995 in the Taiwan Area, 9 were laboratory-confirmed (0.04 confirmed cases per 100,000 population). This was 2.25 times more than the 4 confirmed cases of 1994. Again, of the reported cases in 1996, 14 were laboratory-confirmed (0.06 confirmed cases per 100,000 population). This was 1.56 times more than the 9 confirmed cases in 1995. The increase of confirmed cases in two successive years deserves some consideration.

2. Confirmed Cases by Sex

Of the 9 confirmed cases in 1995, 3 (33.3%) were male and 6 (66.7%), female, giving a male-female sex ratio of 1:2. Of the 14 confirmed cases in 1996, 7 each were either male or female, giving a sex ratio of 1: 1. The US statistics are that there are

Figure 1. Methods for Identification of *Neisseria meningitidis* Currently Practiced by NIPM, DOH[9]

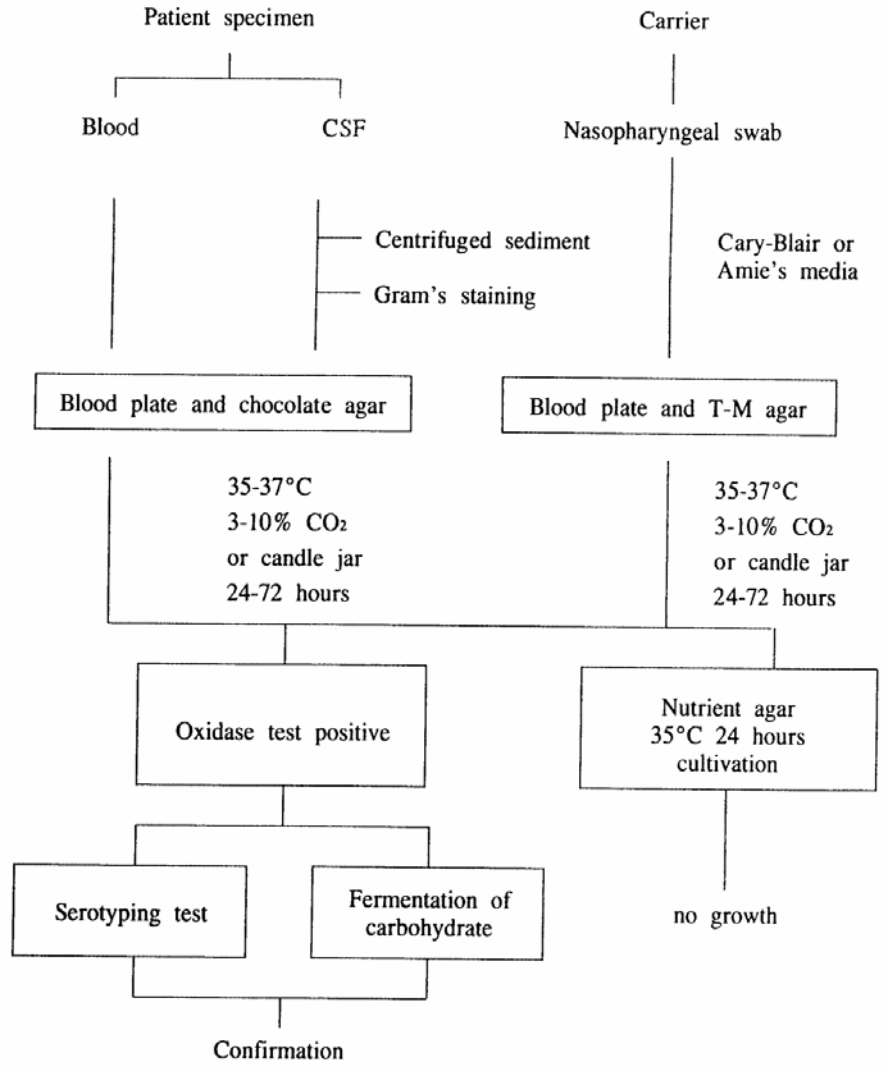


Figure 2. Age Distribution of Cases of Meningococcal Meningitis in the Taiwan Area, 1995 and 1996

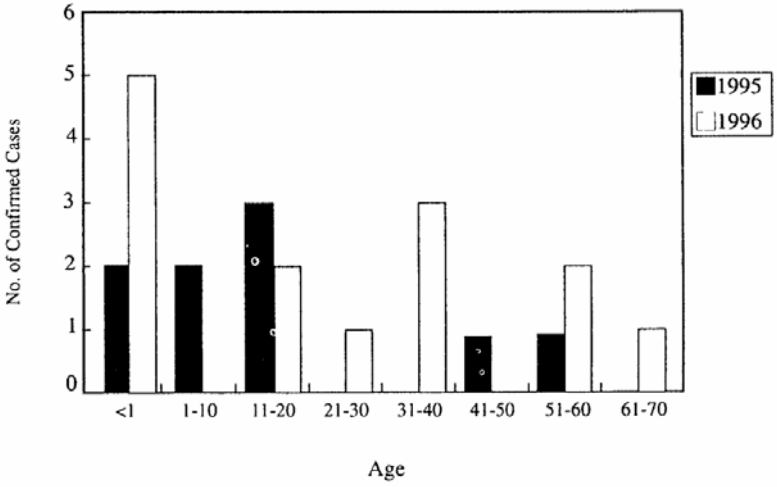
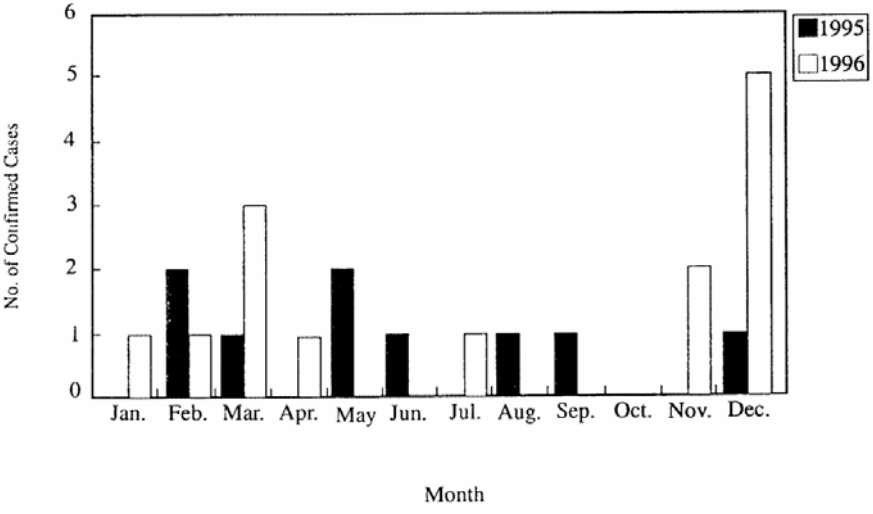


Figure 3. Cases of Meningococcal Meningitis by Month of Onset, Taiwan Area, 1995 and 1996



more male than female cases[10]. In Taiwan, more female cases are noted.

3. Confirmed Cases by Age

Of the 9 confirmed cases in 1995, 2 were under one year of age; 2 in the 1-10 year group; 3 in the 11-20 year group; and 1 each in the 41-50 and 51-60 year groups. Of the 14 confirmed cases in 1996, 5 were under one year of age; 2 in the 11-20 year group; 1 in the 21-30 year group; 3 in the 31-40 year group; 2 in the 51-60 year group; and I in the 6 1-70 year group. Their age distribution is shown in Figure 2. In the US, the highest attack rate is found in children under one year of age at 14 cases per 100,000 population [10]. In Taiwan in 1996, the number of cases was the highest among children of one year of age and under.

4. Confirmed Cases by Month of Onset

The 9 confirmed cases in 1995 were distributed: 2 in February, 1 in March, 2 in May, 1 in June, 1 in August, 1 in September, and 1 in December. The 14 confirmed cases in 1996 were distributed: 1 in January, 1 in February, 3 in March, 1 in April, 1 in July, 2 in November and 5 in December. It is rather peculiar that 35.7% of the confirmed cases concentrated in December. Meningococcal meningitis is a worldwide infectious disease more prevalent in spring and winter. Epidemics, however, occurred irregularly [10]. In Taiwan, cases seem to concentrate in winter. The distribution of confirmed cases by month is shown in Figure 3.

5. Confirmed Cases by Area

The 9 confirmed cases in 1995 were distributed: one each in Taipei City, Taipei County, Taoyuan County, Hsinchu County, Taichung County, Taichung City, Chiayi County, Tainan County and Hualien County. The 14 confirmed cases in 1996 were distributed: 4 in Taipei City, 3 in Changhua County, 2 in Taipei County, and one each in Taoyuan County, Hsinchu County, Taichung County, Chiayi City and Tainan County.

6. Serotypes of *Neisseria meningitidis* isolated from Confirmed Cases

The laboratory-confirmed serotypes of the 9 *N. meningitidis* strains in 1995 were: 5 of group B, 2 of group W-135 and 2 of unknown types. Of the 14 strains in 1996, 10 were of group B, and 4 of group W-135.

More cases in the US are caused by groups B, C, Y, and W-135 organisms. Group A organisms cause worldwide epidemics. 99.2% of the organisms isolated from infected patients are of groups A, B, C, Y and W-135; while 76.8% of those isolated from healthy carriers are of these five types. More group B organisms were isolated from either infected patients or healthy carriers [10]. A similar result is noted in Taiwan.

7. Death Cases

Of the 9 confirmed cases in 1995, 2 had died: one one-year old girl of Taichung County and one five-year old girl of Taipei County in 1-3 days after onset. They were both infected with group B organisms. None of the 14 confirmed cases in 1996 had died.

8. Treatment of Meningococcal Meningitis

Penicillin G is used for the treatment of *Neisseria meningitidis*. For those allergic to penicillin G, cefotaxime or chloramphenicol are used instead. For the details of treatment, see reference [11].

9. Control of Meningococcal Meningitis

All patients should be under respiratory tract isolation before and for 24 hours after antibiotics treatment. All contacts at home or in nurseries, and all medical and nursing personnel in close contact with patients before treatment should be medicated with antibiotics for prevention for 24 hours after the confirmatory diagnosis of patients. For details of preventive measures, see reference [11].

10. Treatment at Time of Epidemics

At time of epidemics, preventive measures should be taken. For details on disease surveillance, isolation, medication and effects of vaccine, see reference [12].

Some serious epidemic outbreaks occurred in Europe and Africa in 1996. Now that international travelling is more frequent, diseases are more likely to be transmitted internationally. In the Taiwan Area, meningococcal meningitis infections increased in 1995 and 1996. Health workers at all levels should be more alert to the prevention of this infectious disease.

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References:

1. Mandell GL, Douglas RG, Bennett JE. Principle and Practice of Infectious Disease, 3rd ed., Churchill Livingstone Co., New York, 1990; 1600-1613.
2. Murray PR, Drew WL, Kobayashi GS, et al. Medical Microbiology, CV Mosby Co., London, 1990; 85-90.
3. WHO. Newsletter, 27 June 1996.
4. Department of Health. Health and Vital Statistics, Republic of China, 1991, 1992,

1993, 1994, 1995; National Institute of Preventive Medicine. Statistics, 1996.
5. National Institute of Preventive Medicine, DOH. Manual for the Collection of Specimens for Disease Control. Nankang, Taipei, 1995; 7.
6. Baron S, Jennings PM. Medical Microbiology, 13th ed., Churchill Livingstone Inc., New York, 1991; 241-247.
7. Murray PR, Baron EJ, Pfaller MA, et al. Manual of Clinical Microbiology, 6th ed., ASM Press, Washington DC, 1995; 324-340.
8. KY Wang, JF Chang. Microbiology, National Institute of Translation and Compilation, 1933; 504-511.
9. National Institute of Preventive Medicine, DOH. Standard Operational Procedures for Laboratory Testings, Nankang, Taipei, 1995; 1.28-1.29.
10. Feldman HA. The meningococcus: a twenty year perspective, Rev Infect Dis 1986; 8:288.
11. TM Pan. Treatment and prevention of meningococcal meningitis, Epidemiology Bulletin, 1996; 12:315-322.
12. Department of Health. Manual for the Control of Communicable Diseases, Taipei, 1996, 1-7.