

Bacillary Dysentery in Taiwan Area in 1995 and 1996

Abstract

In the Taiwan Area, 644 cases of bacillary dysentery were reported in 1995; of them, 562 were laboratory confirmed. Of the confirmed cases, 278 (49.5%) were male and 284 (50.5%) female. Most cases (457, 81.2% of all cases) were under 14 years of age: 265 cases in the 5-9 age group; and 125 in the 10-14 age group. Many cases occurred in December (224, 39.8%) and November (183, 32.6%). Cases were reported from 15 counties and cities, in particular from Taoyuan County (407, 71.4%), Ilan County (54), Hualien County (30), Taipei County (25) and Taitung County (15). Most cases (81.5%) were of type D (*Shigella sonnei*), type B (*S. flexneri*, 18.0%), and fewer of type C (*S. boydii*, 0.5%) infections. No type A (*S. dysenteriae*) infection was reported. Six outbreaks involving 457 cases (81.2% of total) occurred during the year (an outbreak being an epidemiological clustering of five or more cases). There were 8 imported cases during the year: 3 males and 5 females of ages ranging from 22 to 73 years.

In the Taiwan Area in 1996, 375 cases of bacillary dysentery were reported; of them, 256 were laboratory confirmed. Of the confirmed cases, 111 (43.4%) were male and 145 (56.6%) female. Many cases (161, 62.9%) were under 24 years of age: 57 cases in the 5-9 age group, 54 in the 0-4 age group, 24 in the 20-24 age group, and 20 in the 10-14 age group. Many cases occurred in January-February (84, 32.8%) and August-September (56, 21.9%). Cases were reported from 18 counties and cities, in particular from Taoyuan County (70, 27.3%), Taipei County (51), Nantou County (40), Hualien County (27), and Taipei City (16). Many cases (61.7%) were of type B (*Shigella flexneri*) and type D (*S. sonnei*, 37.6%). Type C (*S. boydii*, 0.3%) and type A (*S. dysenteriae*, 0.3%) infections were fewer. Five outbreaks involving 102 cases (39.8%) occurred during the year. There were 39 imported cases during the year: 7 males and 32 females.

Introduction

Shigella is one of the major pathogenic agents of intestinal tract infections

throughout the world. Clinical symptoms range from acute disorders of bacillary dysentery, or Shigellosis, such as abdominal pain, fever and watery diarrhea to non-acute, mild gastro-intestinal symptoms. Serotypes of genus *Shigella* come in four main groups: group A, *S. dysenteriae*; group B, *S. flexneri*; group C, *S. boydii*; and group D, *S. sonnei*. Through O antigen classification, groups A, B and C can further be divided into 45 serotypes and subtypes. Group D has only one serotype⁽¹⁾.

Globally, groups B and D infections occur more frequently. Group D infection is more often found in industrialized countries; whereas group B infection occurs more often in developing countries^(2, 3). Bacillary dysentery is a notifiable disease in Taiwan. In the past years, the infections have always been of groups B and D, occurring more often between June and October each year primarily, unless it is a general outbreak, in the eastern and northern parts of the island⁽⁴⁾. In the last few years (1993-1996), there had been several major outbreaks and some sporadic infections. The number of cases seem to have increased, a 5.8-fold increase from 112 reported cases in 1994 to 644 cases in 1995, for instance; or, an 8.9-fold increase from 63 laboratory confirmed cases in 1994 to 563 cases in 1995. In 1996, the number of reported cases dropped to 375, and the number of laboratory confirmed cases to 256. This sharp increase in the number of both reported and confirmed cases deserves close attention.

Materials and Method

1. Collection of Specimens⁽⁵⁻⁸⁾

Once a patient is suspected of bacillary dysentery infection, the doctor fills out the infectious disease report form to notify local health authorities. Specimens such as feces, intestinal contents of the deceased, and drinking water if the source of infection is considered to be water supply, are also collected at the same time and sent to the National Institute of Preventive Medicine of the Department of Health for laboratory testings. The following procedures should be followed in the collection of specimens.

1) collection of fecal specimens:

The procedures described in the Manual of Clinical Microbiology should be followed in the collection of fecal specimens from patients⁽⁵⁾.

2) collection of specimens from the deceased:

Contents of the large and small intestines should be collected. The specimens should then be handled like the fecal specimens of patients.

3) drinking water:

If possible, use water collector to collect water specimens directly from wells installed with water plugs or pumps. For tightly covered wells, collect water

specimens after emptying first the water in the pipe or the pump. Containers should be sterilized before use. The amount to be collected is one liter⁽⁶⁾.

2. Laboratory Procedures

Standard laboratory procedures currently practiced by the National Institute of Preventive Medicine of the Department of Health is shown in Figure 1. The process is in three parts: the isolation of suspicious bacteria, identification of the biochemical characteristics of the bacteria and identification of serotypes.

1) Isolation cultivation

No enrichment media are yet available for the testings of *Shigella* from all kinds of specimens, isolation cultivation media are used for isolation. As the number of *Shigella* is relatively small in drinking water, millipore filter is used together with culture media for the isolation of bacteria^(5,7).

Two isolation cultivation media are commonly used: the *Salmonella-Shigella* agar (SS agar) and the xylose lysine desoxycholate agar (XLD agar). SS agar is more selective and therefore, is more suitable for the identification of *Shigella*. SS agar contains citrate and sodium thiosulfate which can strongly inhibit the growth of *E. coli*⁽¹⁻⁸⁾.

2) Selection of suspicious colonies

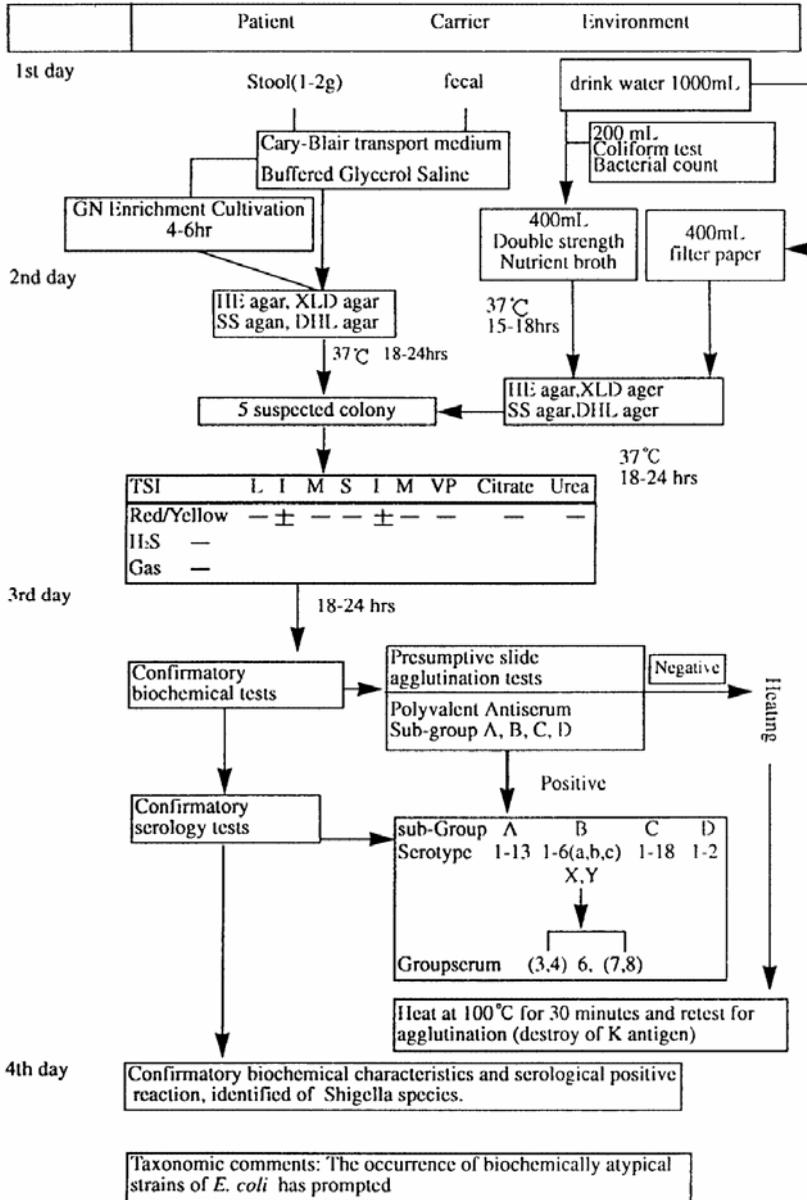
The colorless or slightly pinkish colonies of 1-2 mm in diameter developed on the SS agar can be considered *Shigella*, they should be transferred to the differentiation media for characteristic identification. *Shigella* grows slightly better on XLD agar than on SS agar. They develop into either colorless and cloudy or slightly pinkish and cloudy colonies of 2 mm in diameter. Colonies other than *Shigella* are also present. Like colonies on SS agar, they can only be differentiated through identification cultivation⁵.

3) Identification cultivation

When colonies on SS agar and XLD agar are suspected *Shigella*, they should be transferred to the differentiation media for the identification of their biochemical characteristics. Not all characteristics have to be assessed. The following three differentiation media are sufficient to identify *Shigella*⁵.

Three media, namely: triple sugar iron agar (TSI), lysine iron agar (LIA) and sulfide-indole-motility agar (SIM) are used for identification. Use platinum wire to touch lightly the central part of the suspected *Shigella* colony on the isolation cultivation medium, smear it on the whole slanting surface of the TSI agar, and then puncture

Figure 1. Standard Laboratory Procedures for Dysentery Bacillus Testing, NIPM



the upper part. For LIA agar, the slanting surface is punctured. For SIM, the same colony is hooked and then smeared on the entire surface. The upper part is then punctured. Inoculated identification media are placed under 37°C for 18-24 hours for observation.

4) Serological testings

Serotypes of the strains identified through identification cultivation are further typed by using diagnostic sera⁽⁸⁾.

Results and Discussion

1. Laboratory Testings for *Bacillus Dysenteriae* in the Taiwan Area

644 cases of bacillary dysentery were reported (3.05 reported cases per 100,000 population) in the Taiwan Area in 1995. This was 5.8 times more than the 112 cases reported in 1994. Of them, 563 cases were laboratory confirmed (2.67 confirmed cases per 100,000). This was 8.9 times more than the 63 confirmed cases of 1994. The sudden increase in the number was due primarily to the large scale outbreak in a primary school in Taoyuan County. 375 cases were reported (1.58 reported cases per 100,000) in 1996. This was 0.58 times of the 644 cases reported in 1995. Of them, 256 cases were laboratory confirmed (1.08 confirmed cases per 100,000). This was 0.45 times of the 562 confirmed cases in 1995. No deaths were reported in either year.

2. Characteristics of Bacillary Dysentery Cases

1) by sex

Of the 562 confirmed cases in 1995, 278 (49.5%) were male and 284 (50.5%) female, giving a male-female sex ratio of 1:1.02. Of the 256 confirmed cases in 1996, 111 (43.4%) were male and 145 (56.6%) female, giving a sex ratio of 1:1.31.

2) by age

Due to the large scale outbreak in a primary school in Taoyuan County, more cases in 1995 (457 cases, 81.3% of all cases) were under 14 years. 265 cases (47.2%) were in the 5-9 age group; 125 (22.2%) in the 10-14 age group; and 67 cases (11.9%) in the 0-4 age group. Many cases in 1996 (161 cases, 62.9% of all cases) were under 24 years: 57 (22.3%) in the 5-9 age group, 54 (21.1%) in the 0-4 age group, 24 (9.4%) in the 20-24 age group, and 20 (7.8%) in the 10-14 age group. The distribution of positive cases by age is shown in Table 1.

Table 1. Distribution of Positive Cases by Age

Age	0-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70-79	Unknown	Total
1995	67	265	125	5	11	15	14	7	16	7	30	562
1996	54	57	20	6	41	12	17	14	15	15	5	256

3) by month

Due to the large scale outbreak in a primary school in Taoyuan County, more cases in 1995 occurred in December (224 cases, 39.8% of all cases) and November (183 cases, 32.6%). Due to some outbreaks, more cases in 1996 occurred in January- February (84 cases, 32.8% of all cases; including 24 cases carried over from the outbreak in a primary school in Taoyuan County in 1995, 17 cases of a psychiatric institution in Tamshuei, and 21 cases of a tour group to Indonesia), August-September (56 cases, 21.9% of all cases; including 34 cases from an outbreak in Jenai Township of Nantou County), and April (29 cases, 11.3% of all cases; including 22 cases from an outbreak in Fuhshing Township of Taoyuan County). The distribution of positive cases by month is shown in Figure 2. Due to an outbreak, more cases in 1995 occurred in December and November. Due to some outbreaks, more cases in 1996 occurred in two peaks, January-February and April.

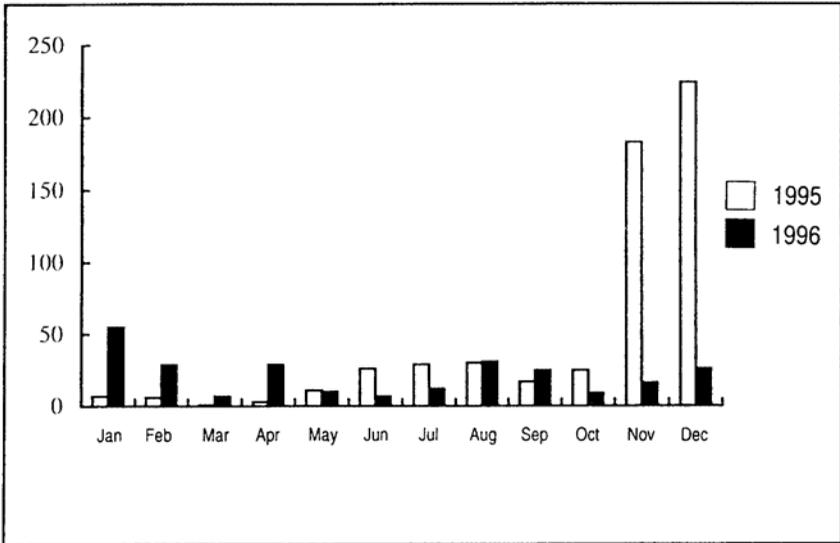
4) by area

In 1995, cases were reported from 15 counties and cities, in particular from Taoyuan County (407 cases, 71.4% of all cases), Ban County (54 cases), Hualien County (30 cases), Taipei County (25 cases), Taitung County (15 cases) and ten other counties and cities each with 10 and fewer reported cases (Taipei City, Nantou County, Taichung County, Hsinchu County, Changhua County, Miaoli County, Tainan County, Kaohsiung County, Taichung City and Lienchiang County). In 1996, cases were reported from 16 counties and cities, in particular from Taoyuan County (70 cases, 27.3% of all cases), Taipei County (51 cases), Nantou County (40 cases), Hualien County (27 cases), Taipei City (16 cases), Ilan County (15 cases), Hsinchu County (13 cases) and Taichung County, Taitung County, Yunlin County, Chiayi County, Pingtung County, Hsinchu City, Taichung City, Tainan City and Kaohsiung County, each with 10 and fewer reported cases.

5) by serotypes

Of all cases in 1995, more were of type D (*Shigella sonnei*) (459 cases, 81.5%

Figure 2. Distribution of Bacillary Dysentery Positive Cases by Month 1995 and 1996



of all cases), type B (*S. flexneri*) (101 cases, 18.0%), and fewer of type C (*S. boydii*) (2 cases, 0.5%) infections. No type A (*S. dysenteriae*) infection was reported. Of all cases in 1996, more were of type B (*S. flexneri*) (158 cases, 61.7%), and type D (*S. sonnei*) (96 cases, 37.6%). Type C (*S. boydii*) (1 case) and type A (*S. dysenteriae*) (1 case) infections were fewer.

6) outbreaks

Six outbreaks involving 457 cases (81.3% of all cases in the year) occurred in 1995 (an outbreak being an epidemiological clustering of five and more cases). Details of these outbreaks are shown in Table 2. Five outbreaks involving 102 cases (39.8% of all cases in the year) occurred in 1996. Details are shown in Table 3.

7) cluster

Eight clusterings of 22 cases were noted in 1995 4 in families involving 12 cases, one in a primary school involving 3 cases, one in a nursery involving 3 cases, and two in the neighborhood involving 4 cases. In 1996, 17 clusterings of 42 cases were noted 12 in families with 28 cases, one in a nursing home involving 4 cases, and four in groups involving 10 cases.

Table 2. Outbreaks of Bacillary Dysentery in 1995

Incident	Date	Place	No. of patients	Agent	Route of transmission
1st	Jun-Jul	Psychiatric Institution, Tamshuei, Taipei County	11: 2 males 9 Females	<i>S. flexneri</i>	Cross-infection between men
2nd	Jul-Aug	Kindergarten, Ilan County	15: 18 children 1 teacher 6 family members	<i>S. sonnei</i>	Cross-infection between men
3rd	Sep-Oct	Primary School, Ilan County	6: 4 children 2 family members	<i>S. flexneri</i>	Cross-infection between men
4th	Sep-Oct	Neighborhood, Taoyuan County Hsinchu County	5: 4 family members 1 relative	<i>S. flexneri</i>	unknown
5th	Nov-Jan	Primary School, Taoyuan County	404: 384 children 5 teachers 15 family members	<i>S. sonnei</i>	contaminated underground water, cross-infection between men
6th	Dec-Jan	Kindergarten, Taipei County	6 4 children 2 family members	<i>S. flexneri</i>	Cross-infection between men

Table 3. Outbreaks of Bacillary Dysentery in 1996

Incident	Date	Place	No. of patients	Agent	Route of transmission
1st	Jan	Nursing Home, Taipei County	17: 11 males 6 females	<i>S. flexneri</i>	Cross- infection between men
2nd	Jan-Feb	Junior College, Taipei County	21: 1 male 20 females	<i>S. sonnei</i>	Imported
3rd	Mar-Apr	School, Home, Taoyuan County	22: 10 males 12 females	<i>S. flexneri</i>	Cross- infection between men
4th	Aug-Sep	Community, Nantou County	34: 10 males 24 females	<i>S. flexneri</i>	Unknown
5th	Dec	Families, Hsinchu County	8: 3 males 5 females	<i>S. sonnei</i>	Contaminated underground water

8) imported cases

In 1995, there were 8 imported cases: 3 males and 5 females aged between 22 and 73. They were: 4 cases from Vietnam (2 *S. flexneri*, one each *S. boydii* and *S. sonnei*), one from Malaysia (*S. sonnei*), one from Middle East (type unknown), one from the Philippines (*S. sonnei*), one from Guinea-Bissau (*S. boydii*). In 1996, 39 cases were imported: 7 males and 32 females aged between 1 and 59. They were 3 cases from Vietnam (2 *S. flexneri* and 1 *S. sonnei*), 31 cases from Indonesia (24 *S. sonnei*, 5 *S. flexneri*, 1 *S. dysenteriae* and 5 *S. flexneri*), 4 from Hong Kong and Thailand (*S. flexneri*) and one from Myanmar (*S. flexneri*).

3. Disease Prevention

Dysentery bacilli are relatively weak in the environment; their distribution is more confined than other bacilli. However, under temperate and humid seasons and environment, they can survive for long. For instance, in humid soil, they can survive for 8 days; 20 days in warm water of 37°C; 10 days in cold water of 10°C; 1-2 weeks in vegetables; and even 7-10 days under dry conditions (5). They are not heat-resistant and die in 10 minutes under 60°C; in 30 seconds under 100°C; and in 30 minutes under sun light. They are, however, cold-resistant and can survive in ice cubes for 96 days or survive through winter. Vinegar on the market cannot kill them immediately (9).

S. sonnei is more resistant to environment. Experiments show that *S. sonnei* can grow under 5-10°C; grow and reproduce the best under 20-30°C; though cannot grow under 37°C. Room temperature is most adequate for their survival (5).

Excrements of patients or carriers are the major source of infection. Transmission is through food, feces, fingers and flies. Environmental sanitation, therefore, is most important in the prevention of the infection. As many cases are inapparent without symptoms, their management is difficult. If possible, patients should be isolated until the fecal culture is negative. Prophylactic medication is recommended at time of mass infections (4).

Pulsed-field gel electrophoresis (PFGE) (10-12) is a useful tool of serotyping. It should be used for better understanding of the serotypes of dysentery bacilli in Taiwan. Research in this regard is currently ongoing at the National Institute of Preventive Medicine. With the use of this molecular biology technique, the serotyping of dysentery bacilli in Taiwan can be further improved and the infections better understood for more effective control.

Acknowledgement

Thanks are due to the staff of the Central Branch, Southern Branch, Eastern Branch and laboratories of the Division of Bacteriology of the National Institute of Preventive Medicine, Department of Health, for their laboratory testings.

Prepared by: TM Pan¹, TK Wang¹, MH Lai², SF Tsai², CM Wang³, SM Hsu³

1 National Institute of Preventive Medicine, DOH

2 National Quarantine Service, DOH

3 Bureau of Communicable Disease Control, DOH

References:

1. Mandell GL, Douglas RG and Bennett JE. Principles and Practice of Infectious Diseases, 3rd ed., Churchill Livingstone Co., New York, 1990:1716-1722.
2. Baron S, Jennings PM. Medical Microbiology, 13th ed., Churchill Livingstone Inc., New York, 1991:327-335.
3. Noriega FR, Lian FM, Formal SB, et al. Prevalence of *Shigella* enterotoxin among *Shigella* clinical isolates of diverse serotypes. *J Infect Dis* 1995; 172:1408-1410.
4. Pan TM. Trend of infection and prevention of dysentery. *Epidemiology Bulletin* 1996; 12:212-219.
5. Farmer JJ, Kelly MT. Enterobacteriaceae. In: Balows A, Hausler JWJ, Herrmann KL, et al. eds. *Manual of Clinical Microbiology*, 5th ed., American Society for Microbiology, Washington DC, 1991; 360-383.
6. Szturm-Rubinsten S. Determination of biotype, phage type and colicinogenic character of *Shigella sonnei* and its epidemiologic important. *Arch Immunol Ther Exp* 1968; 16:42 1-428.
7. Faruque SM, Haider K, Rahman MM, et al. Differentiation of *Shigella flexneri* strains by rRNA gene restriction patterns. *J Clin Microbiol* 1992; 30:2996-2999.
8. Liu PY, Lau YJ, Ru BS, et al. Analysis of clonal relationships among isolates of *Shigella sonnei* by different molecular typing methods. *J Clin Microbiol* 1995; 33:1779-1783.
9. Sheng IP. *Prevention and Control of Some Common Food Poisonings*. Holiday Press, Taipei, 1992; 47-50.
10. Wong HC, Lu KT, Pan TM, et al. Subspecies typing of *Vibrio parahaemolyticus* by pulsed-field gel electrophoresis. *J Clin Microbiol* 1996; 34:1535-1539.
11. Maslow JN, Slutsky AM, Arbeit RD. Application of pulsed-field gel electrophoresis to molecular epidemiology. In: Persing DH, Smith TF, Tenover FC, et al. eds. *Diagnostic Molecular Microbiology: Principles and Applications*. American Society for Microbiology, Washington DC, 1993; 563-572.
12. Pan TM, Lee CL, Lin CS, et al. Subspecies typing of *Shigella* isolated from outbreaks in Taiwan, 1995-1996. *Formosan J of Med* 1997; 1:152-158.