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A Preliminary Survey of a Typhoid Epidemic in the City of Samchunpo During 1967*

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SUMMARY

An outbreak of typhoid fever in Samchunpo city was surveyed and the results were summarized as follows:

1. 638 of clinical cases were detected in 17 Dongs (districts) of the city of Samchunpo, (54,064), during the epidemic period from 1st September to the end of November, 1967.
2. The morbidity rate was 1,189 per 100,000 population; (1,300 female, and 1,060 male).
3. The highest peak was reached in the third week of September and a second peak appeared at the end of September 1967.
4. The mode of infection was suspected strongly as a water-borne and the source of infection as an old public well called Gal-Dae-Saim, since the causative agent was found in close public latrine and the contaminated sewage ditch which was connected with the well.
5. All patients and carriers were treated at their home under the supervision of local medical authorities.
6. The Gal-Dae-Saim was closed immediately on 7th October, 1967 by the order of the mayor.
7. At the end of November, 1967 when the outbreak in Samchunpo was almost ended, another small epidemic occurred in Koseong county which bordered the eastern outskirt of the city.
8. During the survey, a strain of Shigella flexneri was isolated from the sewage located three meters from Gal-Dae-Saim and also from one case.
9. It was reported by the local health center in May, 1968, that no carrier had been detected in the survey made among the persons who had had typhoid fever in 1967. Also thereafter no cases of typhoid fever were reported through October, 1968.

INTRODUCTION

Korea had annually large or small epidemics of typhoid for many years. Consistent, accurate, and complete records have not been available.

S.T. Kim and S.K. Koh in 1959 reported the typhoid epidemics, which had been officially recorded by the National Institute of Health. These included the following: In 1957, there were 16 cases in Kyong Sang Puk-Do, 70 cases at the Blind and Deaf school in Seoul, 60 cases in Pusan, and 245 cases at Mukho. In 1958, 60 cases were reported in an epidemic on Yondo island.

Recently epidemics have been reported in Keuchang 1964, Hamyang 1965, Tanyang 1966 and Samchunpo in 1967. These reports, with the exception of the one from Samchunpo, are fragmentary.

* *This article was presented at 6th annual meeting of the Korean Society fo Infectious Disease in* 1967.

The present report is that of an epidemic in Samchunpo in 1967. A survey was made of the source, the mode of infection, and common epidemiological features of this country.

METHODS AND RESULTS

1. The physical, social, and cultural background of the city of Samchunpo.

This city was until recently a small fishing port on the southern coast of Korea.

During the past years it has had a rapid increase in population. It is at 34°55′ latitude north and 128°5′ longitude east, so is in the warmer part of the country. The city faces the sea on the south. It is located in Kyong Sang Nam-do Province.

The 1966 census gave the population as 54,064 persons including 27,154 males and 26,910 females living in 9,528 households. The average family size was 5.4 persons.

Over a city area of 870.6 square kilometers this population density was 60.7/sq.Km.

Depending upon the season, most of the inhabitants are farmers or fishermen. Among the 24 Dongs (city districts) only one third had a public supply of pure water.

This came from three small water filtration plants which together produced a total of 1,000 tons per day. Two thirds of the Dongs depended upon 229 public wells and 776 private wells for their drinking water.

Meteorological reports for 1965 and 1966 showed an annual average of 70 days of rain or snow, and 60 cloudy days. One half of the annual 1,000 mm of rain came in July and August of the Korean rainy season.

However, in 1967, there was a very severe drought in southwest Korea. Except for one old well called Gal-Dae-Saim, which was only 3 meters from a large sewage ditch emptying into the sea, most of the other wells became dry. The sewage ditch runs through a very primitive market slum area (Seonkoo) (Fig. 1).

The water level of this main public well was only 50 cm. below the gound, and varied with the level of sewage, as the level of flow in the sewage ditch adjacent to it turned by the tide.

Whenever the well water was removed, for example when it was pumped out, its full 8,000 liter capacity could be rapidly refilled within 40 minutes.

During this drought, most of the people of Samchunpo depended upon the Gal-Dae-Saim, the "Never Dried Spring", for their drinking water.

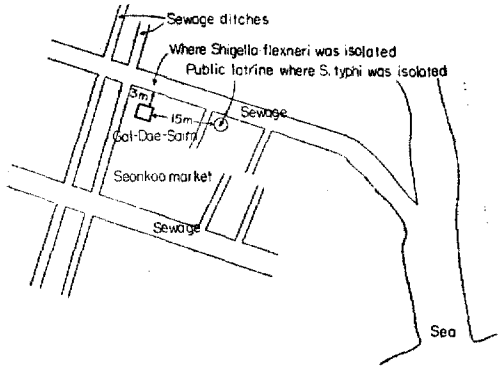

Fig. 1. The geographic relationships between the public latrine, sewage ditches and the Gal-Dae-Saim

II. History of typhoid incidences in the City

In Table 1 are listed the typhoid cases which have been reported in this city since the health centre was established in 1961.

Table 1. Number of reported typhoid cases from 1961 to 1966.

	1961	1962	1963	1964	1965	1966
No. of cases	10	—	—	59	3	25
No. of recovered	7	—	—	59	3	25
No. of death	3	—	—	0	0	0

III. The results of the observations

1. Area involved

Patients were found in the 17 Dongs out of 24 Dongs of the whole city. Among the unaffected 7 Dongs, 3 were supplied by pure water. The most prevalent area was Seonkoo-Dong where the Seonkoo market and the contaminated well, Gal-Dae-Saim, were located (Fig. 2).

The number of patients occurred in this area was 267, more than one third of all the cases in this epidemic. Next to Seonkoo-Dong was Tongseo-Dong with 163 cases and Tongseokeum-Dong with 121 cases, in order, as shown in Table 2.

More than 83% of patients or 531 out of all the 638 cases were detected in three Dongs, namely Seonkoo-Dong, Tongseokeum-Dong and Tongseo-Dong which were very closely located to the old well "Gal-Dae-Saim".

Table 2. Number of clinical cases by different regions (Dongs)

Sex / Dongs	Female	Male	Total
Reegum-Dong	3	3	6
Kungjee-Dong	3	2	5
Bongnam-Dong	2	2	4
Eesoon-Dong	2	3	5
Seonkoo-Dong	153	113	267
Tongseokeum-Dong	57	64	121
Beollee-Dong	7	13	20
Tongseo-Dong	99	64	163
Tonglim-Dong	2	2	4
Yongkang-Dong	2	2	4
Hyangchon-Dong	7	4	11
Silan-Dong	1	8	9
Mato-Dong	1	1	2
Nukto-Dong	6	6	12
Shinsoo-Dong	0	1	1
Roryong-Dong	3	0	3
Juklim-Dong	1	0	1
Total	350	288	638

2. The occurrence of clinical cases and the duration of the outbreak

Two early cases which began early in August were found during the survey.

The epidemic in Seonkoo-Dong, Tongseo-Dong and Tongseokeum-Dong began about the beginning of September and lasted until the middle of October as shown in Fig. 3 and Table 3.

The peak was reached in the third week of September or during 13th to 20th of September, and the fourth week and the fifth week of September made up a protracted second peak.

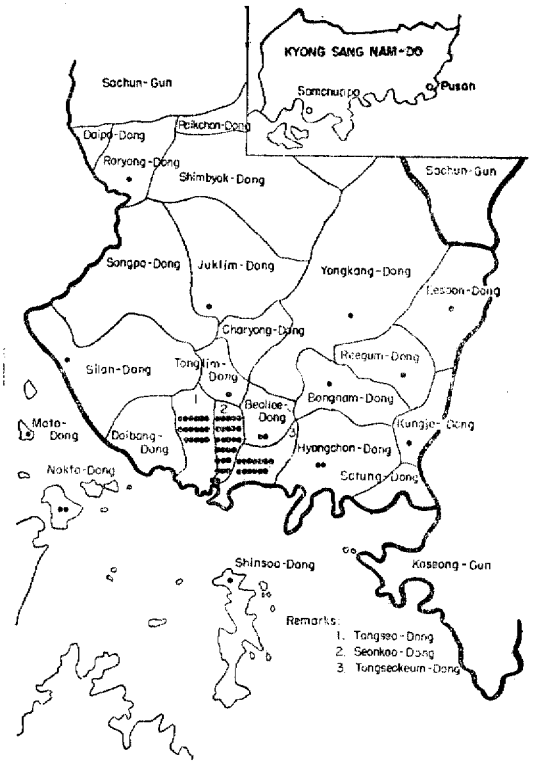

Fig. 2. Distribution of typhoid cases in Samchunpo, 1967

indicates 10 cases of typhoid fever or less

Table 3. Number of cases occurred in Seonkoo-Dong, Tongseo-Dong and Tongseokeum-Dong by week.

	Seonkoo Dong	Tongseo Dong	Tongseo keum-Dong	Total
One month before the epidemic	2	0	0	2
1st-6th Sep. (1st-week)	6	2	0	8
7th-13th Sep. (2nd week)	16	6	3	25
14th-20th Sep. (3rd week)	113	67	32	212
21th-27th Sep. (4th week)	41	29	29	99
28th Sep.-4th Oct. (5th week)	36	50	40	126
5th-11th Oct. (6th week)	5	9	3	17
12th-18th Oct. (6th week)	14	0	6	20
Unknown	34	0	8	42
Total	267	163	121	551

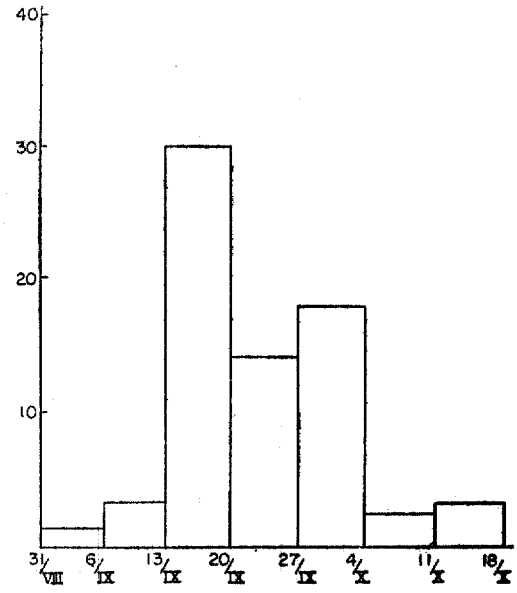

Fig. 3. Number of medn occurrence in a day by week Seonkoo-Dong, Tongseo-Dong and Tongseokeum-Dong

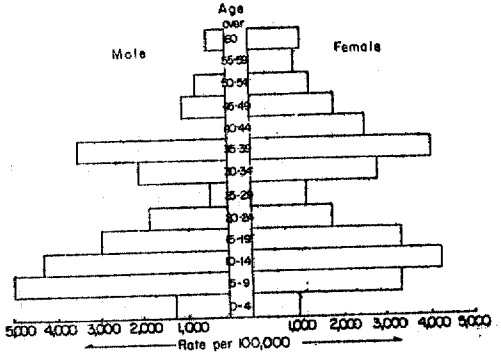

Fig. 4. The Sex and Age Specific Incidence in Seonkoo-Dong, Tongseo-Dong and Tongseokum-Dong

3. Morbidity and mortality rates

The morbidity rate was calculated as 1,180 per 100,000 population with 1,300 in female and 1,060 in male each.

The highest morbidity rate was 3,018/100,000 as shown in Seonkoo-Dong (3,371 female, 2,641 male).

The specific sex and age incidence rates in Seonkoo-Dong were shown as in Fig. 4. The rates were 4,200, 4,400 and 3,750 each in the age groups of 5-9, 10-14 and 35-39, respectively.

Regarding immunization, 17% of 150 random cases had been immunized either with 0.1 ml intradermally or 0.5 ml subcutaneously before the onset of the epidemic.

Unfortunately, it was not possible to determine the differences in disease incidence between immunized and non-immunized groups, because of poor records.

Only one fatal case was reported among 638 cases (0.156%) in this outbreak. This figure may not be significant .

4. Symptomatological analysis

One hundred and fifty patients were selected at random and surveyed for symptoms and signs.

Table 4. Analysis of the symptoms found in 150 random sample

Symptoms	Per cent
Fever	100
Headache	100
Anorexia	81
Chills	69
Extremity pain	66
Backache	50
Constipation	42
Abdominal pain	42
Nausea	34
Myalgia	32
Diarrhea	26
Vomiting	16
Exanthema	16
Cough	8
Bloody stool	2.5

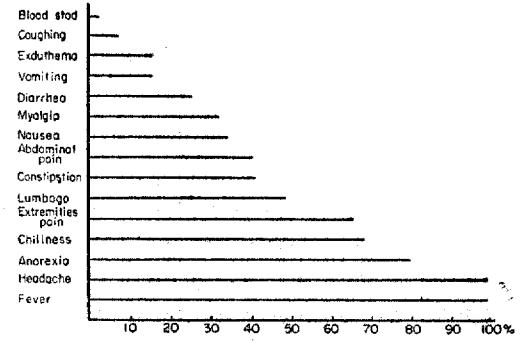

Fig. 5. Symptom to Etiological Analysis of 150 Cases Sampled at random in Samchonpo.

The results were listed with the percentage in Table 4 and in Fig. 5.

The patients should have been analysed according to stages of the disease, but this was not possible, because of other complications at the time of the survey.

All of patients suffered from high fever and severe headache and had several other symptoms typical of the disease.

5. Bacteriological examinations

Among 137 clinical cases fourteen strains of lactose-negative organisms were isolated fro the specimens taken from acute and convalescent patients, and all of them were identified as Salmonella typhi. One strain of Salmonella typhi was isolated from one of 274 healthy contacts.

The same kind of organism was also isolated from one of the fecal specimens taken from the public latrine which was located fifteen meters from Gal-Dae Saim as shown in Fig. 1, but no such organism was isolated from the public wells, private wells or sewages around any of the patients' houses.

A carrier was detected among three persons living in Seonkoo-Dong who had suffered from typhoid fever in July 1966. This might have caused this epidemic.

During search for Salmonella strains in various areas, a strain of Shigella was isolated from the sewage close to the Gal-Dae-Saim and identified as Shigella flexneri.

Incidentally, the surveyors found one case of shigellosis in the city.

The biochemical and serological charateristics of the strains are tabulated in Table 5, Table 6 and Table 7.

Table 5. Biochemical properties of strains isolated

Strains	5S	12B	260S	1−1	10S	331S	20S	32
Morphology*	GNB**	〃	〃	〃	〃	〃	〃	〃
Motility	+	+	+	+	+	+	−	−
K. I. A.	−/A	−/A	−/A	−/A	−/A	−/A	−/A	−/A
H_2S	+	+	+	+	+	+	−	−
M. R.	+	+	+	+	+	+	+	+
V. P.	−	−	−	−	−	−	−	−
Simmon's citrate	−	−	−	−	−	−	−	−
Urea	−	−	−	−	−	−	−	−
Lactose	−	−	−	−	−	−	−	−
Sucrose	−	−	−	−	−	−	−	−
Salicine	−	−	−	−	−	−	−	−
Arabinose	−	−	−	−	−	−	−	−
Mannitol	+	+	+	+	+	+	+	+
Maltose	+	+	+	+	+	+	+	+
Sorbitol	+	+	+	+	+	+	−	−
Inositol	−	−	−	−	−	−	−	−
Mannitol	+	+	+	+	+	+	+	+
Adonitol	−	−	−	−	−	−	−	−
Dulcitol	−	−	−	−	−	−	−	−
Rhamnose	−	−	−	−	−	−	−	−
Raffinose		−	−	−	−	−	−	−

* 5S: 12B and 260S were isolated from patients,
1-1: from the public latrine located 15 meters from the well,
10S: from the carrier who was suffered from typhoid a year ago,
331S: from another epidemic of Koseong county,
20S: from the sewage close to and connect to the Gal-Dae-Saim,
32: from the patient of shigella.

** GNB indicates Gram negative bacilli.

Although the causal agent could not be found in public and private wells, Escherichia coli were detected from the well water of Gal-Dae-Saim and the viable counts showed more than 30,000 per ml.

While this epidemic was about at its end stage, there was another small outbreak in November 1967 in Koseong county contiguous to the eastern outskirt of Samchunpo city, and S. typhi was isolated as listed in Table 5 and 6.

Table 6. Agglutination reaction of the strains isolated

	Salmonella								
	Group O antisera					Factor			
Strains	Poly	Vi	A	B	C	D	E	9,12	d
5S	+	+	−	−	−	+	−	+	+
12S	+	+	−	−	−	+	−	+	+
260S	+	+	−	−	−	+	−	+	+
1−1	+	+	−	−	−	+	−	+	+
10S	+	+	−	−	−	+	−	+	+
331S	+	+	−	−	−	±	−	+	+

Table 7. Agglutination reaction of the strain isolated

	Shigella antisera			
Strain	A	B	C	D
20S	−	+	−	−
32	−	+	−	−

IV. Measures of the control of the epidemic.

1. Attempts were made to emphasize health education to the inhabitants, specially to the food handlers and housewives.
2. Immediate replacement of the Gal-Dae-Saim with a water filtration plant was done by the direct order of the mayor of the city. Subsequently, the Gal-Dae-Saim was completely closed.
3. Collecting human excreta for sanitary disposal.
4. Immunization with a vaccine against typhoid fever.
5. Bacteriological examination of contacts as well as other inhabitants.
6. All detected cases were treated at home under the supervision of the local medical authorities.

DISCUSSION

As in other parts of this country, a carrier was detected in this city and sporadic cases of typhoid fever also had been continuously occurring in the city of Samchunpo during previous years. What was more, it was supposed that carriers or infected persons in the stage of incubation possibly could have come into this city from other areas, such as Kosoeng county for shopping.

As one of the remarkable custom firmly rooted to old culture in this area, the traditional ceremony of the "Autumn festival" has been kept on August 1st of lunar month.

It was suspected that the demand for water might have increased very much by that time of festival in order to prepare various kinds of traditional foods in each house.

By the time, the Gal-Dae-Saim seemed to have been contaminated by huge flow from the sewage due to the continuous consumption of the well water for the special demand of the season, therefore, a large number of persons could have been infected rather in very short period of time.

A carrier survey was done by the health authorities of the city during the Spring of next year but no carriers were detected.

By October 1968, no additional clinical cases of typhoid fever were reported from the city.

However, this fact may not be evidence of a complete control of epidemic sources in this area,

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=國文抄錄=

1967年 三千浦市에 發生된 腸지브스流行에 關한 調査*

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韓國에는 每年 相當한 數의 腸지브스流行이 發生 되고있으나 大部分의 境遇 其記錄이 없거나 或은 至極히 未備한 事實을 否認할수가 없다. 1959年에 金相泰·高相均은 1957年에 發生된 慶北의 16例, 서울盲啞學校의 70例, 釜山의 60例, 墨湖의 245例等과 1958年에 發生된 全北熙島의 60例를 要約한바 있으나 居昌(1964年) 咸陽(1965年)및 丹陽(1966年) 等의 大流行에 關하여서는 別로 記錄되어 있는바가 없다. 이러한 點에 비추어 著者等은 1967年에 慶南三千浦市에 發生된 腸지브스 流行에 關하여 調査한바 있으므로 이에 記錄하는 바이다.

1. 人口 54,064의 三千浦市에 638名의 患者가 發生하여 1,180/100,000이라는 高率의 罹患率을 나타냈고 死亡은 1名이었다.

2. 이 流行은 1967年 9月初에 始作되어 同年 11月末에 終熄되었으나 最高患者發生時期는 9月中 第三週였으며 繼燃流行曲線은 10月中旬까지 繼續되었다.

3. 感染經路는 水因性이었으며 感染源은 陳舊된 井戶(갈매샘)이었다.

4. 原因菌은 Salmonella typhi로 同定되었다.

5. 모든 患者와 保菌者는 三千浦市 醫師會의 監督下에 在家治療되었다.

6. 調査期中에 1年前에 腸지브스에 罹患되었든 3名中에서 1名이 保菌者로 나타났으며 Shigella flexneri에 依한 痢疾患者도 1名檢出되었다.

7. 1967年 11月 三千浦市流行이 거의 끝날무렵 隣接固城郡에도 腸지브스發生이 報告되었으며 亦是 Salmonella typhi가 檢出되었다.

8. 1968年 春季에 實施된 前年度患者에 對한 保菌者檢索에서 1件의 保菌者도 檢出되지 않았으며 1968年 10月까지의 報告에서는 1件의 新患도 發生되지 않았다.

*本 論文의 內容은 1967年 第6次 感染學會學術大會에 報告되었음