

THE SECOND GENERATION OF “YUSHO” - 39 YEARS AFTER PCBs/ PCDFs EXPOSURES -

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Abstract

The health status of the children of Yusho is reported by their parents 39 years after the outbreak of an accident. 85% of them are found to have some diagnosed diseases and symptoms on various organs. The effects of PCBs / PCDFs exposure might have been persisting in decades which affected subsequent generations.

Introduction

The food poisoning “Yusho” broke out in 1968 involving 14,000 people. From the first generation of Yusho patients who directly ingested the rice oil contaminated by PCBs / PCDFs, the second and the third generation were born during those years. Though many Yusho children suffered from unexplained difficulties of health, the study to examine their present health status was not conducted. In 2002-2006, we have conducted several questionnaire surveys on the 1st generation of Yusho⁽¹⁾. As for their children, the information reported by their parents in those questionnaires are closely examined.

Methods

In 2002-2006, we collected questionnaires from 80 women / 59 men (control: 101 women / 31 men). Among them, 90 patients who were exposed to PCBs/PCDFs before their marriage (under 22 years of age) were selected. The follow-up study of their marriages, children, and children’s health were conducted. Children born from them were studied by 3 groups: mother exposed group, father exposed group, mother and father exposed group. In addition, long-term reproductive effects of early exposed Yusho women on their children were examined ; and many of them whose mothers were exposed to contaminated oil in childhood have several health problems.

Results and Discussions

(1) Marriages and pregnancies of the 1st generation who were exposed in their early age.

Out of 90 Yusho patients who were exposed before their marriage, 22 (23.3%) remained single 39 years after the outbreak (Versus National Survey: Single rate as of age 50: 2.5% in 1970, 9.15% in 2000). From the married Yusho patients, a total of 85 pregnancies were reported which included pregnancies from contaminated parents: (exposed women/exposed men, exposed women/unexposed men, unexposed women/exposed men). Out of 85 pregnancies, 20 (23.5%) were lost before births by miscarriages and abortions (Versus National Statistics: Miscarriages 4.06% in 1970, 2.88% in 1980. Abortion 2.47% in 1970, 1.81% in 1980). 65 children were born, 3 (4%) were postnatal deaths within one year. (Versus National Statistics: Infant death: 1.3% in 1970). 62 children survived.

(2) Children’s health status.

Out of 62 children, 53(85%) had one or more doctors diagnose diseases and other symptoms. Two most prevalent diseases found here were otitis media (8:12%) and low height (8:12%).The Yucheng children who were exposed in utero had been reported to have higher frequencies of ear infection⁽²⁾. In addition, Inuit children, whose mothers had higher levels of PCBs and dioxins in their breast milk, experienced more episodes of acute

otitis media⁽³⁾. The prenatal and postnatal exposures to PCBs/PCDFs might have suppressed the immune function of Yusho children as well. The problem of low height was reported frequently from Yusho parents. As the increase in fetal deaths and intrauterine growth retardation were reported soon after the outbreak of Yusho in 1971⁽⁴⁾, the prevalence of low height children reported decades later might have been the outcome of those fetal problems.

Other diseases found in this study are as follows:

In the reproductive system, anovulation (1), amenorrhea (1), short and thick penis (1), sex-chromosome aberration (1), late menarche (2), dygenesis of birth canal (1), endometriosis (1), menorrhagia (3), infant metrorrhagia (1) are reported. In the behavior and nervous system, learning disorder (1), autonomic imbalance (1), lack of concentration (1), hyperkinesia (1), and panic disorder (1) are reported. Other diseases on bone, teeth, eye, ear and cancer etc are myeloma (1), deformation of spinal cord (1), cervical discopathy (1), non growth of adult teeth (1), glaucoma (1), amblyopia (4) meniere's disease (2), deafness (1), sensitive to sound (1), cancer of cornea (1), urinary bladder cancer (1), breast cancer (1), hyperventilation (1), cholecyst polyp (1), gastritis (1), gastric ulcer (1), asthma (6), obesity (3), Kawasaki disease (2). Diseases on the entire body.

(3) Exposure route and effects.

16 children whose mother and father were exposed, were seriously affected as shown in table #1. Among them, 8 children were born in 1968, when the most contaminated oil was circulated, two of them have died, 6 are suffering from several diseases even now. There are no clear differences found between the mother exposed group (39) and the father exposed group (10). However, birth defects such as a hole in the heart, ventricular septal defect, deformation of finger, were found in the father exposed group. These findings have to be examined further as male-mediated developmental toxicity.

(4) The duration of trans-placental exposures

The duration of trans-placental exposure to high dose of contaminated oil in the case of Yusho has to be re-discussed, as in the Yucheng' study, the children born between 1978 to 1987 (until 10 years after the outbreak) who were regarded as being exposed in utero to high dose of PCBs/PCDFs⁽³⁾. However, in Yusho, officially recognized circulation of the high dose of PCBs/PCDFs contaminated oil was only limited to the year of 1968. The evidence found here suggests the possibilities that many of the diseases of the children born after 1968 could be the outcome of trans-placental exposures. Suppose certain exposure memories of the toxins in mother's uterus persist and its effects remain for many years, the facts found here in Yusho children can be better explained.

Some examples of the long duration of the contaminated mother's uterus are as follows:

Mother's exposed age was 24, she repeated 3 miscarriages and 1 stillbirth by 31 years old..

A girl born in 1972 as a premature baby, 4 years after mother's exposure, had teeth from her birth.

A girl born in 1980, 12 years after mother's exposure, developed endometriosis when she grown up.

(5) Early exposure of the mother - late effects on children.

In the present study, a boy born in 1981(13 years after mother's exposure) developed urinary bladder cancer when he became 20 years old. His mother's exposed age was 12. A similar case is reported in DES (diethylstilboestrol) children whose mother was exposed to a high dose of endocrine disruptive chemicals, developed cancer when they became adults. These problems of the trans-placental carcinogenesis are needed to

be explored in Yusho's case.

The evidence of early exposure-late effect found in Yusho women's case is as follows:

Mother's exposed age was 3 and she suffered from meniere's disease, vertigo, amblyopia, eczema, allergy. Her daughter is suffering from Kawasaki disease, and severe amblyopia.

Mother's exposed age was 4 and she suffered from ovarian cyst, and varix. Her daughter developed breast cancer when she became an adult.

Mother's exposed age was 6, out of 4 pregnancies of her, two were miscarriages, one was postnatal death, one survived.

Mother's exposed age was 7 and she suffered from ovarian cyst, menorrhagia, salpingitis, hyper-menorrhea, numbness of hand, deformation of fingers and nails, purpura. Her daughter suffers purpura and asthma.

Mother's exposed age was 9 and she suffered from endometriosis, hyper-menorrhea, esophageal ulcer, gastric ulcer and gallbladder polyp. Her daughter suffers sex-chromosome aberration, low height, otitis media.

Mother's exposed age was 12 and she suffered meniere's disease, cholecystitis, rheumatism, heart disease, ovarian cyst, arthritis, gout, neuralgia, hyperventilation. Her daughter is suffering from renal disease, otitis media, menorrhagia, hematuria, alopecia, obesity, diarrhea, allergy and abdominal pain.

The risk of childhood exposures to the toxins have long been pointed out as the child sensitivity to the toxins are very high as compared to the adult. The findings here show that early exposures to high level PCBs/PCDFs have severe effects on women's reproductive health and their children's health.

The evidence of Yusho children found here suggests that the effects of PCBs/PCDFs might have been handed down to the subsequent generations even decades after the parents' exposures. The health effects revealed here are found in the children's entire body, expanding from reproductive system to nervous system, from skeleton to ear and nose. Long-term follow-up study of Yusho children is needed for elucidating the generations' risk. In order to get the overview of the physical damages of Yusho families, we are drawing genealogical view of 50 Yusho families today as a first trial. In addition, the study to examine the total-PCBs of preserved umbilical cord of Yusho children is on the way which is a cooperative work we are conducting with Setsunan University⁽⁵⁾. Accumulation of those evidence will surely enlighten the generations' risk of PCBs/PCDFs.

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| Table 1. Second Generation of "Yusho" -Diseases and symptoms found- ¹⁾ | | | | | |
|---|---------------|----------|-----|------------------------|---|
| | Year of birth | Age 2007 | Sex | Exposure ²⁾ | Diagnosed diseases and symptoms |
| 1 | 1968 | dead | M | | cola baby/asthma |
| 2 | 1968 | dead | M | | cola baby/frequently had high fever |
| 3 | 1968 | 39 | M | | cola baby/blindness of left eye/urethral disorder/hyperkinesia/Learning disorder/short and thick penis/sensitive to sound/diarrhea |
| 4 | 1968 | 39 | F | | cola baby/cervical discopathy/deformation of spinal cord/meniere's disease/milk tooth would not fall out/myeloma/constipation/clavus/autonomic imbalance/anovulation/otitis media /kidney tumor |
| 5 | 1968 | 39 | F | | meniere's disease/deafness of left ear |
| 6 | 1968 | 39 | F | | cola baby/chlor acne/asthma/born in suspended animation |
| 7 | 1968 | 39 | F | | cola baby/premature baby/low height |
| 8 | 1968 | 39 | F | | cola baby/frequently becomes dyspnea/eye mucus/ weak trachea/darknails |
| 9 | 1970 | 37 | M | | high uric acid value/glaucoma/choleyst polyp/intercostal neuralgia/dark complexion/operated phimosis/diarrhea/bronchitis |
| 10 | 1970 | 37 | M | | gastritis/gastric ulcer/nurosis/having fastidious nature |
| 11 | 1971 | 36 | M | | non growth of adult teeth (2of anterior teeth) |
| 12 | 1972 | 35 | F | | premature baby/had teeth from her birth/low height |
| 13 | 1972 | 35 | F | | menorrhagia/otitis media/lumbago/constipation/menoxenia/atopy |
| 14 | 1973 | 34 | F | | menorrhagia/allergy/atopy/menoxenia |
| 15 | 1974 | 33 | F | | premature baby/had teeth from her birth |
| 16 | 1980 | 27 | F | | deformation of right hand finger/generarized atopy/metal allergy |
| 17 | 1980 | 27 | F | | endometriosis/ panic disorder |
| 18 | 1981 | 26 | M | | premature birth/bad liver function/urinary bladder cancer (age 20)/alopecia/dark gingive |
| 19 | 1982 | 25 | F | | premature birth/renal disease/allergy/otitis media/hematuria/ obesity/menorrhagia/alopecia/diarrhea/abdominal pain |
| 20 | 1983 | 24 | F | | sex chromosome aberration/low height/amenorrhea/otitis media/dermatosis/heart disorder/obesity |
| 21 | 1986 | 21 | M | | amblyopia / kawasaki disease |
| 22 | 1989 | 18 | F | | low height/ dark complexion/scelalgia |
| 23 | 1990 | 17 | M | | breast cancer |
| 24 | 1990 | 17 | M | | ventricular septal defect |
| 25 | 1990 | 17 | M | | allergy/ asthma/ low height/ milk tooth would not fall out |
| 26 | 1990 | 17 | F | | pyelitis/ late menarch/ hyperventilation |
| 27 | 1991 | 16 | M | | a hole in the heart |
| 28 | 1992 | 15 | F | | uterine hemorrhage/kawasaki disease/otitis media/abdominal pain/constipation/obesity |
| 29 | 1993 | 14 | F | | cancer of cornea |
| 30 | 1996 | 11 | M | | lack of concentration/ eye troubles |

1) 30 subjects out of 65 are listed here.

2) Exposure Route: Mother exposed, Father exposed, Mother and Father exposed