Sudden Infant Death Syndrome in Twins and Singletons in Japan, 1995-2008

Yoko Imaizumi* and Kazuo Hayakawa
Department of Health Sciences, Graduate School of Medicine, Osaka University, Japan

Abstract

Objective: To compare the infant mortality rate (IMR) due to sudden infant death syndrome (SIDS) in twins and singletons and consider the risk factors of SIDS.

Materials and methods: The IMR due to SIDS was analyzed among twins and singletons from 1995 to 2008 using the Japanese Vital Statistics.

Results and discussion: The IMR for both twins and singletons decreased (1/3-1/4) significantly during 1995-2008 and was significantly higher among twins than in singletons during 1995-2000 and 2003-2004. The relative risks of SIDS for maternal age groups between <25 years and 30-34 years were 9-fold for twins and 3-fold for singletons. The IMR increased with parity for both 1st- and 2nd-born twins. Seasonal variations were observed in IMRs for twins and singletons. The time of death from 4 a.m. to 7 a.m. was a risk factor for SIDS in twins and singletons.

Conclusion: The relative risks for SIDS in twins and singletons decreased after 2005. The SIDS IMR was lower in Japan than in the US, the UK, and Canada which related to lower percentage of prone and facedown sleeping position in Japan. The concordance rate of SIDS was uncommon in twins. Younger maternal age is a risk factor for both twins and singletons.

Keywords: Sudden infant death syndrome; Twins; Singletons; Risk factors

Introduction

According to vital statistics in Japan, congenital malformations (37.4% among total number of infant deaths) was the first leading cause of deaths in 2010, the second was respiratory and cardiovascular disorders (13.9%), and third was sudden infant death syndrome (SIDS) (5.7%). The former two causes of death consists of a set of many detailed lists of codes in the International Classification of Diseases, 10th Revision (ICD-10) [1], but SIDS has only one code (R95, ICD-10®). The proportion of SIDS deaths among the total number of infant deaths was 10.4% in 1995, which decreased to 5.5% in 2008. In the US, the IMR due to SIDS decreased from 1.2 per 1000 live births in 1992 to 0.56 in 2001, but the IMR has remained constant from 2001 to 2006 [2]. Much of the decrease in IMR due to SIDS was because of the change in sleeping position for both twins and singletons in England and Wales from 1993 to 2003 [3].

Risk factors for death due to SIDS are race, sleeping position [4], tobacco [5], seasonality [6], twins [7], zygosity [3], maternal education level [8], and birth weight (BW) [9]. A primary cardiac channelopathy was estimated to cause 5%-15% of SIDS cases [2].

The purpose of this study was to compare the IMRs in twins and singletons and consider the risk factors of SIDS.

Materials and Methods

Data on live births and infant deaths were obtained from the vital statistics of Japan for the duration of 1995-2008 (Health and Welfare Statistics and Information Department, Ministry of Health, Labour and Welfare, Japan); these data cover the entire population of Japan. Death certificate records provide information concerning nationality, sex, dates, BW, Gestational Age (GA), parental age, single or multiple births, birth order of multiple births, cause of death, and other details. ICD-10 for 1995-2008 assigned SIDS with the code R95. Birth certificate records contain this same information, except for data related to death. In Japan, Early Neonatal Death (END) refers to cause of death of a live-born infant occurring <7 completed days from the time of birth and Neonatal Mortality Rate (NMR) refers to the number of children <28 days of age who die per 1000 live births. Post-Neonatal Mortality (28 days-1 year of age) Rate (PNMR) and IMR refer to the number of these deaths (after birth up to 1 year of age) per 1000 live births.

Expectation values were computed by multiplying the total number of SIDS deaths by a proportion of total number of days in each season to test the seasonality of the IMRs. The number of SIDS deaths of twins in each hour was small. Then number of deaths was divided into four continuous hours to compute the χ2-test. Expectation values were obtained by multiplying the total number of deaths by 1/6 (e.g., 25 for twins and 66.8 for singletons).

The MZ twinning rate (per 1000 births) during 1995-2008 was presumed on the basis of the considerations given below (rates per 1000 births). The MZ twinning rate remained nearly constant between 1975 (3.7) [10] and 1998 (4.3) [11]. In the present study, the MZ twinning rate was assumed to be 4.35 per 1000 births during 1995-2008 [12]. To compute IMRs due to SIDS among like- and unlike-sexed twins, denominators for both types of twin pairs were estimated on the basis of the considerations given below. The total twinning rate was computed as the number of live birth twins divided by 2 and multiplied by 1000 and divided by the total number of live births in each year. Then, the DZ twinning rate was estimated by the total twinning rate minus the MZ rate (4.35 per 1000 live births) in each year. Weinberg’s method [13] was used to estimate the total number of like- and unlike-sexed twins, which is shown in table 2. As for numerators, we analyzed the data from the Japan-linked birth and death certificate tapes from 1995 to 2008 to find the co-twin of SIDS twins. We used odds ratio (OR) to test the difference between IMRs for males and females, for twins and singletons, and between maternal age groups as well as GA and BW.

*Corresponding author: Yoko Imaizumi, Invited Professor, Department of Health Sciences, Graduate School of Medicine, Osaka University, Japan; Tel & Fax: +81-78-928-6027; E-mail: yoko1234go@m5.gyao.ne.jp

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Results

Trend in infant mortality

Table 1 shows the number of SIDS infant deaths and IMRs for singletons and twins from 1995-1996 through 2007-2008. The proportion of SIDS infant deaths among total infant deaths was 3.8% for twins and 9.3% for singletons during the period 1995-2008. IMRs for both twins and singletons significantly decreased during the period. The overall IMR was 0.49 per 1000 live births in twins and 0.26 in singletons; it was significantly higher in the former than in the latter [OR, 1.9-95%CI, 1.6-2.2]. SIDS IMR was significantly higher in males than in females during the periods 1995-1996 and 1999-2000 for twins and during each two-year period for singletons. IMRs were computed using overall information for number of deaths, including unknown maternal age (Table 1). Distribution of maternal age at birth has changed for the last decade. Next, age-adjusted IMR was computed for the period 1999-2008. Crude IMRs excluding deaths due to SIDS in unknown maternal age groups were computed, but the crude and age-adjusted IMRs were similar during each two-year period for twins and singletons. However, the maximum difference between the two types of IMR was 0.03 per 1000 live births during 2003-2004 for twins and 0.01 during 2005-2008 for singletons. Namely, decreased IMR was not significant for both twins and singletons with BWs <2500 g. In contrast, the relative risk (1.5-fold) was significantly higher in twins than that in singletons with BWs ≥ 2500 g. The IMR was only significantly higher in twins (0.30) than that in singletons (0.15) for those with GA of ≥ 38 weeks. Proportion of unknown BW was 0% (0/152) in twins during 1995-2008 and the percentage of unknown GA was 2.3% (2/88) in singletons during 1999-2008. In contrast, the corresponding values in singletons were 11.1% (447/4009) and 12.3% (273/2217), respectively. From table 2, the IMR due to SIDS was similar for the first-born (0.46) and second-born twin (0.48) during 1995-2008. Table 2 also shows the IMR due to SIDS according to like- and unlike-sexed twin deliveries from 1995 to 2008. The IMR was 0.43 for like-sexed twins and 0.33 for unlike-sexed twins, which was not significantly different. The concordance rate of SIDS was 1/151 pairs of twins. Table 3 shows the IMR due to SIDS according to sex, maternal age, BW, and GA in twins and singletons. The highest IMR was 1.30 per 1000 live births for twins and 0.38 for singletons among mothers aged <25 years, whereas the lowest rate was 0.15 for twins and 0.13 for singletons among mothers age 30-34 years. The twin-singleton relative risk (3.4-fold) was statistically significant at the 5% level for mothers aged <25 and 25-29 years. The highest IMR in twins was 1.37 per 1000 live births for those with BWs <1500 g and decreased to 0.30 for infants with BWs ≥ 2500 g. The corresponding rates in singletons were 1.23 and 0.20, respectively. The relative risk between both BWs was 4.6-fold for twins and 6.1-fold for singletons. The IMR was similar for both twins and singletons with BWs <2500 g. However, the relative risk (1.5-fold) was significantly higher in twins than that in singletons with BWs ≥ 2500 g. The IMR was only significantly higher in twins (0.30) than that in singletons (0.15) for those with GA of ≥ 38 weeks. Proportion of unknown BW was 0% (0/152) in twins during 1995-2008 and the percentage of unknown GA was 2.3% (2/88) in singletons during 1999-2008. In contrast, the corresponding values in singletons were 11.1% (447/4009) and 12.3% (273/2217), respectively.
SIDS occurred between 12 a.m. and 11 a.m. (50%) and between 12 and 11 p.m. (50%) in twins, whereas the corresponding values in singletons were 70% and 30%, respectively. The relative risk ratio of ENDs in the morning to these in the afternoon was 1 for twins and 2.3-fold for singletons. In contrast, the percentage of infant deaths due to SIDS in hospitals or clinics was 72.8% (110/151) for twins and 64.5% (2580/4001) for singletons. The percentage of infant deaths due to SIDS occurring at home was 25.8% for twins and 31.8% for singletons. The relative risk ratio of infant deaths in the morning to those in the afternoon was 1 (55/55) for twins and 1.3-fold (1468/1112) for singletons in hospitals and clinics, whereas the corresponding relative risk ratio of deaths at home was 2.9-fold (29/10) and 2.7-fold (926/347), respectively. Therefore, a higher relative risk of infant deaths due to SIDS in the morning occurred at home compared at hospitals or clinics.

**Seasonality of SIDS**

Table 4 also shows number of deaths due to SIDS according to four seasons for twins and singletons during 1995-2008. The proportion of deaths was significantly higher in winter (December-February) for twins and singletons and higher in spring for singletons compared with the expected proportion of deaths (25%). In contrast, the proportion of deaths in summer and autumn were significantly lower than the
value of expected deaths for singletons. Remarkable differences in the number of deaths among four seasons were obtained for both twins and singletons.

### Discussion

In singletons, percentages of higher risk factors for SIDS from 1999-2003 to 2004-2008 decreased slightly for mothers aged <30 years (from 62.9% to 60.5%), for GA of <35 weeks (6.7% to 6.0%), for proportion of non-low BW (>2500 g) infants [7]. Then, the IMRs due to SIDS for both singletons and twins were lower in Japan than those in the U.S. A prone and facedown sleep position is a risk factor of SIDS [4]; however, the relative risk for SIDS in maternal age groups of <30 and ≥ 30 years was 2.5 (2.2–2.8) in Canada and 1.5 (1.3-1.6) in Japan. Then younger maternal age is a risk factor for both twins and singletons.

According to Malloy and Freeman [8], the concordance of SIDS is uncommon (7/760=0.9%). A similar result was obtained in the present study (1/151=0.7%).

Limitation of the present study was lack of information concerning BW and GA in singletons. Percentage of missing values for SIDS infants was 11.1% for BW and 12.3% for GA in singletons, whereas the corresponding value in twins was 0% and 2.3%, respectively. Another limitation was to find the co-twin of a SIDS twin. Sixteen percent of co-twin with a SIDS twin could not be determined because of a changed address between at birth and death.

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### References

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