

The Changes in the Mortality Rates of Low Birth Weight Infant and Very Low Birth Weight Infant in Korea over the Past 40 Years

Total 36 reports on the mortality rates (MRs) of low birth weight infants (LBWI) and very LBWI (VLBWI) in Korea from the 1967 through 2001 were analyzed. We compared the changes in the MR by 5 and 10-yr interval. The MRs observed by 5-yr intervals from the early 1960s through the 1990s have drastically decreased. The MRs of LBWI are as follows: 23.1% and 23.6% in the 1960s, 17.3% and 16.8% in the 1970s, 14.1% and 14.4% in the 1980s, and 8.1% in the early 1990s. The MRs of VLBWI have also fallen and were reported as follows: 68.2% and 63.7% in the 1960s, 55.8% and 57.6% in the 1970s, 56.2% and 48.1% in the 1980s, 33.5% and 24.5% in the 1990s, and 11.7% in the early 2000s. In every 10-yr period, the MRs of LBWI have decreased from 23.4% in 1960, to 17.0% in 1970, to 14.2% in 1980, and to 8.1% in 1990. The MRs of VLBWI also have decreased from 66.2% in 1960, to 56.7% in 1970, to 50.8% in 1980, to 32.9% in 1990, and to 11.7% in 2000. The MR of LBWI and VLBWI has gone down remarkably due to improvements in neonatology in Korea as shown above.

Key Words : *Survival Rate; Mortality; Infant, Low Birth Weight; Infant, Very Low Birth Weight; Infant, Premature; Infant, Newborn; Infant; Korea*

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INTRODUCTION

There are several methods to evaluate the healthcare situation of a nation. Among them, infant mortality rate and neonatal mortality rate can be one of the important indicators. These two are closely related to each other and reducing the neonatal mortality rate is essential in reducing the infant mortality rate.

The infant mortality rate in Korea have decreased remarkably up to 7.7 per 1000 in 1996 from 61.8 per 1000 in 1965 (1). It was 3.8 in Japan and 7.8 in the U.S.A. in 1996 respectively (1). It is still around 100 in developing countries. Since the deaths during neonatal period makes up over 50% of total deaths in infancy, neonatal care is critical in reducing infant mortality rate.

Premature infants, who are born in less than 37 weeks of gestational age (2, 3), make up about 8% of total births on average. By birth weight, infants under 2,500 g are categorized as low birth weight infants (LBWI). Among these LBWIs, those under 1,500 g are categorized as very low birth weight infants (VLBWI), and infants under 1,000 g as extremely low birth weight infants (ELBWI) (2, 3) Both LBWIs and premature infants are considered high-risk infants because most premature infants are LBWI. These infants need special care and treatments such as neonatal intensive care because they have high morbidity and mortality rates. Therefore, managing these premature infants and LBWIs to survive without

complication will ultimately be the most important method in reducing neonatal mortality rate.

In neonatology, the survival condition for premature infant is considered to be gestation over 23-24 weeks and a birth weight more than 500 grams. When a premature infant meets this condition, it has possibilities of survival and should be given appropriate treatments. Recent treatments for the micro-preemies, infants who weigh 500 to 1,000 grams have been increased their chance of survival.

It has been 40 yr since neonatology was introduced in Korea as a subdivision of pediatrics and focused on the care of premature infants. The mortality rate of premature infants was high at the beginning because of poor machines and equipment as well as under-trained staffs, but it has gone down a lot for the past 40 yr due to improvement in these poor conditions. For the last several decades, in neonatal care, especially in care for premature infants, the survival rates of premature infants have improved thanks to the development of incubator care, mechanical ventilator (e.g., conventional and high frequency ventilator) and special medication (e.g., exogenous artificial pulmonary surfactant, nitric oxide), and improvement of intensive care units. As a result the survival rates of VLBWI and ELBWI are also increasing (4, 5).

When the survival rates and the prognosis of premature infants are discussed, studies on LBWI and VLBWI are generally used. Survival rates and mortality rates of LBWI and VLBWI have been reported in journals of pediatrics and obstet-

rics since the 1960s in Korea.

In this study, reports on survival of premature infants over the last 40 yr were analyzed, and changes in mortality rate of LBWI and VLBWI were compared in both 5-yr and 10-yr intervals. This study was conducted to evaluate the progress of premature infant care and to compare it with that of developed countries such as the U.S.A. and Japan.

MATERIALS AND METHODS

Reports on the survival rates and the mortality rates of

LBWI and VLBWI in Korea from the 1960s through 2001 were compared, and the results from a total of 36 related reports (6-41) were combined and analyzed.

Table 1 shows the number of births and deaths of LBWI and VLBWI from the 36 reports (6-41). First, the samples were divided into LBWI and VLBWI, and the number of deaths among LBWI and VLBWI were estimated in 5-yr intervals and in 10-yr intervals. Then, the numbers of deaths of LBWI and VLBWI were converted into percentages against the numbers of total LBWI or VLBWI, respectively.

The number of LBWI in the second half of the 1990s and the first half of the 2000s was not reported, therefore, is not

Table 1. Summary of reports in mortality of low birth weight infant (LBWL) and very low birth weight infant (VLBWI) during last forty years (1960-2001) in Korea

No.	Reported year	Study period	Classification	No. of LBWI	No. of death	Mortality (%)	No. of VLBWI	No. of death	Mortality (%)	Ref. No.
1	1967	'59-'65	'60A	480	118	24.6	103	76	73.8	6
2	1967	'59-'64	'60A	327	60	18.3	50	32	64.0	7
3	1969	'59-'68	'60A	304	79	26.0	64	40	62.5	8
4	1970	'65-'69	'60B	574	139	24.2	86	48	55.8	9
5	1969	'62-'68	'60B	499	114	22.8	85	61	71.7	10
6	1975	'72-'75	'70A	213	25	11.7	29	16	55.2	11
7	1976	'72-'75	'70A	441	50	11.3	56	20	35.7	12
8	1976	'71-'74	'70A	467	104	22.3	71	40	56.3	13
9	1977	'72-'76	'70A	121	12	12.0	11	3	27.3	14
10	1977	'73-'75	'70A	113	12	10.6	11	6	54.5	15
11	1977	'70-'72	'70A	878	184	21.0	120	92	76.7	16
12	1978	'68-'76	'70A	325	55	16.9	62	24	38.7	17
13	1978	'75-'76	'70B	137	13	9.5	18	9	27.3	18
14	1981	'74-'78	'70B	547	94	17.2	93	57	61.3	19
15	1981	'76-'80	'70B	383	52	13.6	69	38	55.1	20
16	1982	'79-'80	'70B	464	86	18.5	73	50	68.5	21
17	1982	'75-'80	'70B	542	117	21.6	110	57	51.8	22
18	1982	'79-'81	'70B	332	41	12.4	50	27	54.0	23
19	1990	'79-'81	'80A	532	75	14.1				24
20	1984	'80-'82	'80A	1,434	234	16.3	218	142	65.1	25
21	1986	'79-'83	'80A	398	28	7	39	20	51.3	26
22	1986	'80-'84	'80A	433	61	14.1	65	40	61.5	27
23	1988	'81-'86	'80A				137	71	51.8	28
24	1986	'83-'84	'80A	326	61	18.7	46	37	80.4	29
25	1986	'80-'84	'80A				107	42	39.3	30
26	1986	'82-'84	'80A	435	41	9.4	62	27	43.5	31
27	1990	'83-'88	'80B	723	91	12.6	91	62	68.1	24
28	1993	'88-'90	'80B	736	83	11.3	95	58	61.1	32
29	1994	'87-'91	'80B				143	51	35.7	33
30	1993	'89-'91	'80B	338	43	12.7	47	27	57.4	34
31	1993	'86-'90	'80B	1,602	321	20.0	581	237	40.8	35
32	1992	'83-'91	'80B	1,172	119	10.2	122	63	57.6	36
33	1992	'86-'89	'80B				152	101	66.4	37
34	1991	'85-'90	'80B				90	36	40.0	38
35	1998	'89-'95	'90A				318	100	31.4	39
36	1998	'94-'95	'90A	171	21	12.3				39
37	2001	'94-'96	'90A				92	23	25.0	40
38	1997	'96	'90A	12,632	1,017	8.1	2,193	749	34.2	41
39	2001	'96-'98	'90B				169	40	24.5	40
40	2001	'99-'00	'00A				120	14	11.7	40

A, first half of the decade; B, second half of the decade.

included in this study.

RESULTS

Mortality rate changes of LBWI and VLBWI by 5-yr intervals

As shown in Fig. 1, the mortality rates of LBWI in the first half and the second half of the 1960s was 23.1 and 23.6% respectively. Those numbers drastically decreased to 17.3% and 16.8% in the 1970s, 14.1% and 14.4% in the 1980s, and 8.1% in the early 1990s.

In Fig. 1, the mortality rates of VLBWI were 68.2% and 63.7% in the early and late 1970s respectively. These numbers also fell over the last 40 yr to 55.8% and 57.6% in the 1970s, to 56.2% and 48.1% in the 1980s, to 33.5% and 24.5% in the 1990s, and to 11.7% in the early 2000s.

Mortality rate changes of LBWI and VLBWI by 10-yr intervals

Fig. 2 shows the changes in mortality rates of LBWI and VLBWI by 10-yr intervals. The mortality rates of LBWI were 23.4% in the 1960s, 17.0% in the 1970s, 14.2% in the 1980s, and 8.1% in the 1990s. Those of VLBWI were 66.2% in the 1960s, 56.8% in the 1970s, 50.8% in the 1980s, 32.9% in the 1990s and 11.7% in the 2000s. As shown above, the mortality rates have fallen quite dramatically over the last 40 yr.

DISCUSSION

According to the definition used by the World Health Organization (WHO) (2, 3), neonates are categorized based on their gestational ages. That is, a premature infant or preterm infant is born in less than 37 weeks of gestation, a term infant

in 37–41 weeks, and a post-term infant in over 42 weeks. In terms of birth weight, an infant under 2,500 g is categorized as a LBWI. Among these LBWIs, an infant under 1,500 g is categorized as a VLBWI, and an infant under 1,000 g as an extremely low birth weight infant (ELBWI) (2, 3). Even though post-term infants, premature infants and LBWI all are high-risk neonates, VLBWI is the main target of neonatal intensive care because VLBWI has especially high mortality rates.

In order to reduce infant mortality rate, improvement in neonatal mortality rates should be the priority, and it is essential to improve the survival rates of premature infants, especially those of LBWI and VLBWI. Thanks to the recent improvement in neonatal intensive care units, care for premature infants have been improving. This intensive care is the focus in the care of LBWI and VLBWI, and this improvement in the care for premature infants is ultimately contributed to the improvement of neonatal prognosis.

The purpose of this study is to find out how much the mortality rates of LBWI and VLBWI have changed and improved in Korea based on analysis of the reports from the past 40 yr.

Discussing the progress of neonatal care in Korea, the first separate neonatal unit was opened in the 1960s and began to take care of neonates independently. In the 1970s, a specialized room for the care of premature infants was opened. In the 1980s, neonatal intensive care units were established to give focused treatment for high-risk infants and premature infants, and mechanical ventilator care and incubator care became widespread. Since 1990, the use of artificial surfactant replacement therapy became common in treating respiratory distress syndrome, which is the most serious disease for premature infants because its morbidity and mortality rates are the highest of the diseases of premature infants. Pulmonary surfactant replacement therapy reduced mortality rates and improved prognosis for premature infants. In 2000, opening the new millennium, management of neonates and premature infants reached toadies situation with the help of evolution of system

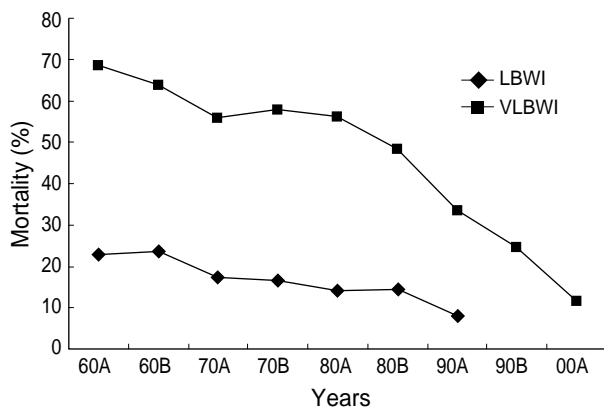


Fig. 1. Changes of mortality in 5-yr interval of low birth weight infant (LBWI) and very low birth weight infant (VLBWI) in Korea. A, first half of the decade; B, second half of the decade.

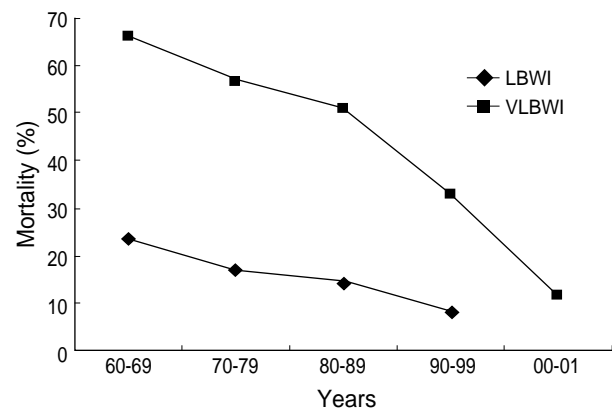


Fig. 2. Changes of mortality in 10-yr interval of low birth weight (LBWI) infant and very low birth weight infant (VLBWI) in Korea.

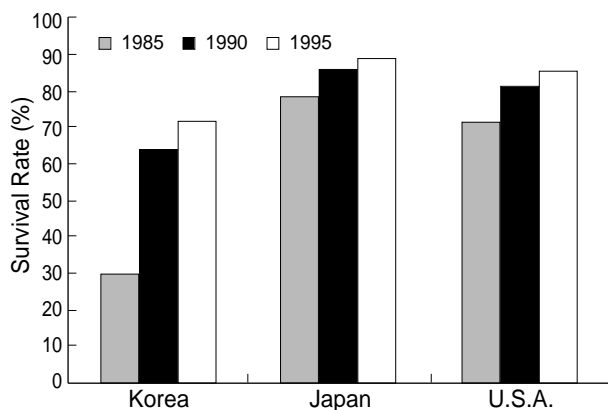


Fig. 3. Comparison of survival rate of very low birth weight infant (VLBWI) in Korea, Japan, and U.S.A.

and quality improvement of staff, spaces, medicine, machines, and skills (4, 5).

This progress of neonatology and the improvement of skills, new drugs, and equipment resulted in the decrease in the mortality rates of LBWI, as shown above. The mortality rates of 23.1% in the first half of the 1960s and 23.6% in the second half of the 1960s fell to 8.1% in the 1990s. In 10-yr intervals, the mortality rate of 8.1% in the 1990s shows conspicuous progress in the improvement of mortality rate, compared to 23.4% in the 1960s. The mortality rates of VLBWI in the first half and the second half of the 1960s were 68.2% and 63.7%, respectively. Their numbers decreased by a lot to 11.7% in the first half of the 2000s. In the 10-yr intervals, 66.2% in the 1960s went down to 11.7% in the 2000s.

Based on the analysis of this study, the mortality rates were compared with the those of the U.S.A. and Japan. The changes of VLBWI survival rates in Korea, the U.S.A., and Japan in the 1980s and 1990s, shown in Fig. 3, are as follows: 30% in Korea, 79% in Japan, and 72% in the U.S.A. in 1985; 64% in Korea, 86% in Japan, and 82% in the U.S.A. in 1990; 72% in Korea, 89% in Japan, and 86% in the U.S.A. in 1995 (4, 5, 42). The survival rate in Korea has not reached that of the developed countries yet. However, in 2000 the survival rate for VLBWIs reached 88% in one hospital. Such progress is very encouraging, although based only on the results of a single hospital.

According to the report from the Korean Society of Neonatology in 2002, the frequency of LBWI and VLBWI in 2001 among 109,316 births in 74 hospitals in Korea was 7.5% and 1.4%, respectively (43). The Korean Statistics Office reported that the number of births was 570,000 in 2001 (44). Therefore, it can be estimated that there are 42,750 LBWI and 7,980 VLBWI each year. To improve the survival rates, appropriate intensive care for neonates is necessary. For these, the various efforts to improve not only the prognosis of premature infants but also that of LBWI and VLBWI should be followed from improvement of staffs and equipment in neonatal intensive care units, to diverse support systems in societies, to the

change of attitude to premature infants, to teamwork, etc.

As the result shows, the progress in the management of LBWI and VLBWI over the past 40 yr was noticeable in Korea; however, it has not reached the level of the U.S.A. or Japan yet. The limitation of survival of a premature infant is a minimum of a 23-24 weeks of gestational period and a minimum of 500 g of birth weight. We need to make an effort to reduce the infant and neonatal mortality rates by the improved treatment of micro-preemies who are born after 23-24 weeks of gestational period or with 500 g of birth weight.

In conclusion, hospitals began to have neonatal nursery units in the 1960s and premature infant care units in the 1970s in Korea. Neonatal intensive care units were established and mechanical ventilator care became available in the 1980s. Artificial surfactant replacement therapy for respiratory distress syndrome has been used since the 1990s. With the adoption of these measures, the mortality rate of LBWI and VLBWI has gone down remarkably over the last 40 yr. The decrease in mortality rates of LBWI and VLBWI due to the progress of neonatology is very encouraging since the recent rates are comparable to those of developed countries such as Japan and the U.S.A. We need to make further efforts to reduce the mortality rates of all infants by reducing mortality rates of LBWI and VLBWI.

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