豫防醫學會誌 第9卷 第1號
Korean J. of Preventive Medicine
Vol. 9, No. 1, October, 1976

Some Biologic Correlates of Perinatal Mortality

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INTRODUCTION

Importance of a satisfactory outcome of each wanted pregnancy cannot be emphasised too much where family planning is advocated and adopted. Hence, early detection of high-risk pregnancies and provision of proper antenatal care of them have become the major concern of Maternal and Child Health Services and Obstetrics.

There are several indices partly representing the MCH status, such as maternal mortality and morbidity, perinatal mortality, infant and childhood mortality and morbidity, hospital and/or so-called "safe" delivery rate and incidence of premature birth, etc.[1] It is well known that the perinatal mortality is a more sensitive one than any other index of MCH, especially of obstetric and postnatal care.[2]

The reliability of these data depends upon the reporting and registration of births and deaths. And only with accurate statistical data it is possible to define the problem, to plan work and to evaluate the results of MCH programmes. Very unfortunately, however, under the present situations few available data can be obtained in Korea. And the data, either on the factors correlated with perinatal mortality, or on the level of this are scarce and meagre.[3, 4, 5] Furthermore, those are not available to sum up the picture of perinatal period demarcating events occurring before and shortly after birth.

It is sure that the MCH programmes, particulary a substantial effort directed towards reducing perinatal mortality, must be developed with good statistical basis, but it is imprudent to defer it until data are fulfilled. It must be realized that the family planning has been adopted as a national policy in this country for nearly ten years before the attention was drawn towards the MCH programmes and its importance.

Therefore, so long as we can get a little bit of reliable guidance to develop MCH programmes from limited data, it may not be impatient to embark in.

In order to make a practical approach to perinatal care, an attempt has been made in this study in terms of assessing the perinatal deaths with some biological factors. Althogh it is not sufficient to draw concrete conclusions for comprehensive relationship between biologic factors and perinatal mortality with this study, surely this study is contributable in some extent to develop MCH programmes.

MATERIAL AND METHODS

All live- and still-births occurring at Seoul

Table 1. Number of Births Occurring at SNU Hospital During 1973-75

Calendar year	Single	Twin	Total	%
1973	835	26	861	35.6
1974	795	26	821	33.9
1975	723	16	739	30.5
Total	2,353	68	2,421	100.0

Table 2. Summary of the Some Biologic Characteristics of the Study Subjects

Characteristics	Number	%	Cum. %
Age of mothers			
under 19	3	.1	.1
20 — 24	217	9.0	9.1
25 — 29	1,282	53.0	62.0
30 — 34	690	28.5	90.5
35 — 39	188	7.8	98.3
40 — 44	38	1.6	99.9
45 and over	3	.1	100.0
Frequency of pregnancy			
1	439	18.1	18.1
2	718	29.7	47.8
3	451	18.6	66.4
4	303	12.5	78.9
5	201	8.3	87.2
6	138	5.7	92.9
7	70	2.9	95.8
8	32	1.3	97.1
9	29	1.2	98.3
more than 10	40	1.7	100.0
Parity			
1	713	29.5	29.5
2	902	37.3	66.7
3	535	22.1	88.8
4	190	7.8	96.7
5	68	2.8	99.5
6	8	.3	99.8
7	5	.2	100.0
Gestational weeks			
before 28 weeks	9	.4	.4
29 — 32	64	2.6	3.0
33 — 36	145	6.0	9.0
37 — 40	1,631	67.4	76.4
after 41	554	22.9	99.3
unknown	18	.7	100.0
Birth-weight (Kg.)			
less than 1.99	108	4.5	4.5
2.00 — 2.49	132	5.5	9.9
2.50 — 2.99	523	21.6	31.5
3.00 — 3.49	1,005	41.5	73.0
3.50 — 3.99	546	22.6	95.6
more than 4.00	106	4.4	100.0
no recording	1	.0	100.0
Sex of newborn infant			
male	1,257	52.0	
female	1,163	48.0	
no recording	1	.0	
Total	2,421	100.0	

Mean age of mothers	= 29.0 ±4.16
Mean frequency of preg.	= 3.17±2.00
Mean number of parity	= 2.19±1.07
Mean birth-weight (Kg.)	= 3.17± .55
Secondary sex ratio	=108.1

National University Hospital, during the period Jan. 1, 1973 through Dec. 31, 1975 have been covered in this study. There were 2,421 births in total; 2,353 single births and 34 twin pairs. (Table 1)

Informations about mothers and infants were obtained from each clinical record. The informations included age, reproductive history, parity and gestational period of mothers, and sex, birth-weight, prematurity, stillbirth and early neonatal death of infants.

The perinatal mortality rates have been analysed with the biologic variables by computer CDC 734-1 Low Speed Batch Terminal at KIFP.

The fllowing definition have been used:

Stillbirth: stillborn infant of 28 gestational weeks or more,

Livebirth: same as defined by World Health Assembly (1950)

Early neonatal death (END): neonatal death occurring during the first week of life,

Perinatal Mortality rate (PMR): number

Table 3. Number of Premature Births Among Livebirths

Assessment	Number	%
premature birth	143	6.1
non-premature	2,204	93.9
Total	2,347	100.0

of stillborn infants and early neonatal deaths per 1,000 total births,

Premature birth: liveborn infant before 37 weeks of gestation and with a birth weight of 2.5Kg or less.

RESULTS

1. Characteristic of the study subjects

Table 2 shows some biologic characteristics of the study subjects.

The majority of the mothers delivered at SNU hospital were in the age group of 20—34 years, and the mean age was 29.0±4.16 years.

The frequency of pregnancy experienced by the mothers ranged from one to twenty-one. And more than 20% of them experienced pregnancies five times or more. The mean frequency was 3.17 ± 2.00.

On the other hand, those who had have five or more parturitions were only 81 (3.3%) out of 2,421. And the mean number was 2.2 ± 1.07.

The distribution of gestational weeks of the cases is also shown in Table 2. The number of livebirths before 28 weeks were nine (0.4%) out of the total.

The average birth weight of the infants was 3.17 ± 0.55Kg. The number and the proportion of the babies weighing 2.49Kg. or less at birth was 240 and 14.4%, respectively.

Male infants were 1,257 and female were 1,163 at birth. The secondary sex ratio proved to be 108.1 per 100 females.

The number of premature births assessed

Table 4. Births and Perinatal Deaths and Its Rate/1,000 Births by Sex and Calendar Year, SUN Hospital, 1973-75

Calendar year	Male				Female				Total			
	TB*	SB**	END***	PMR****	TB*	SB**	END***	PMR****	TB*	SB**	END***	PMR****
'73	433	15	7	50.8	428	15	8	53.7	861	30	15	52.3
74	446	11	6	38.1	374	9	2	29.4	820	20	8	34.1
75	378	10	6	42.3	361	14	7	58.2	739	24	13	50.1
Total	1,257	36	19	43.8	1,163	38	17	47.3	2,420	74	36	45.4

*TB; Total births
**SB; Stillbirths
***END; Early neonatal deaths
****PMR: Perinatal mortality rates/1,000 total births

Table 5. Causes of Death in the First Week of Life Among the Livebirths

Causes	No.	%
Immaturity, A 135	22	61.1
Defects of development, A 127-128	5	13.9
Birth trauma, A 130	4	11.1
Asphyxia and atelectasis, A 131	4	11.1
Infectious and parasitic disease, A 143	1	2.8
Total	36	100.0

Table 6. Births and Perinatal Deaths and Its Rate by Some Biological Factors, SNU Hospital, 1973-75

Factors	Total births	Stillbirth		END		PMR
		No.	Rate*	No.	Rate*	
Age of mother						
under 19	3	1	333.3	—		333.3
20 — 24	217	9	41.5	4	18.8	59.9
25 — 29	1,281	37	28.9	10	7.8	36.7
30 — 34	690	19	25.5	15	22.2	49.3
35 — 39	188	6	31.9	6	33.0	63.8
40 — 44	38	2	52.6	—		52.6
over 45	3	—		—		—
			(Chi square; 16.7 P=.045)			
Frequency of pregnancy						
1	438	12	27.4	3	6.9	34.2
2	718	17	23.7	4	5.6	29.2
3	451	12	26.6	6	13.5	39.9
4	303	9	29.7	8	27.1	56.1
5 and more	510	24	47.1	15	30.3	76.5
			(Chi square; 22.9, P=.000)			
Parity (Birth Order)						
1	712	33	46.3	8	11.4	57.5
2	902	15	16.6	13	14.6	31.0
3	535	14	26.2	10	19.0	44.8
4	190	6	31.6	4	21.5	52.6
5 and more	81	6	74.1	1	12.5	86.4
			(Chi square; 13.6, P=.07)			
Gestational week						
under 28	9	—		—		—
29 — 32	63	14	222.2	18	367.3	507.9
33 — 36	145	16	110.3	3	23.3	131.0
41 and more	554	14	25.3	4	7.5	32.5
unknown	18	2	111.1	—		111.1
			(Chi square; 381.8, P=.000)			
Birth weight (Kg.)						
under 1.99	107	17	158.9	21	233.3	355.1
2.00—2.49	132	13	98.5	2	16.8	113.6
2.50—2.99	523	12	22.9	5	9.8	32.5
3.00—3.49	1,005	19	18.9	5	5.1	23.9
3.50—3.99	546	9	16.5	2	3.7	20.1
over 4,00	106	4	37.7	1	1.0	48.5
			(Chi square; 405.2, P=.000)			
Multiple birth						
singletons	2,353	69	29.3	34	14.9	43.8
twin births	68	5	73.5	2	31.7	102.9
			(Chi square; 5.7, P=.018)			
Total	2,420	74	30.5	36	15.3	45.4

* The stillbirth rate is given per 1,000 total births, whereas the early neonatal mortality rate is calculated per 1,000 liveborn infants.

among the livebirths was 143 out of 2,347. Therefore, the incidence of premature birth at SNU hospital is computed at 6.1% (Table 3).

2. Analyses of perinatal mortality with biologic factors.

The distribution of livebirths, stillbirths (SB) and early neonatal deaths (END) by sex and calendar year is shown in Table 4. Out of 2,421 cases, 74 SB and 36 END were observed. The ratio of SB to END turns out 2.1 : 1. The overall perinatal mortality rate (PMR) was 45.4 per 1,000 births. The differences with the years and sex are not significant (P=0.56).

As Table 5 indicates, out of the total of 36 END cases 22 occurred from immaturity, 5 from the defects of development, 4 from the birth trauma, 4 from the asphyxia and atelectasis and one from pneumonia.

The perinatal mortality rates in relation to some biologic factors are presented in Table 6.

The PMR is higher in the youngest and older age groups of mother, and a mimimum in the age group of 25-29 years. The differences of these rates with age groups are also statistically significant (Fig. 1)

A study on gravidity indicates same tendency in PMR, particularly in END, with a higher rate in primigravida women, a minimum in secundigravida and a progressive rise afterwards. In the parity-specific perinatal mortality rates, however, unlooked-for results are denoted. The differences between parity-specific PMR do not prove statistically significant, while the rates computed display the same pattern as those of gravida-specific (Fig. 2).

Perinatal mortality rates by gestational

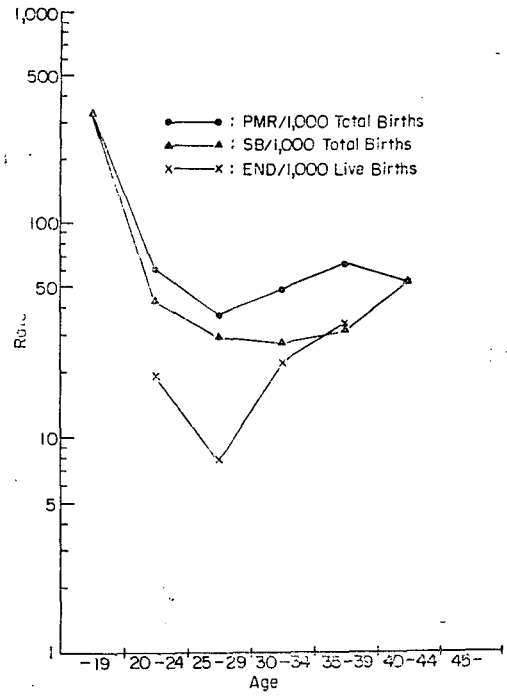

Fig. 1. Rates of Stillbirth (SB), Early neonatal death (END) and Perinatal death (PMR) by Age of mothers in Semilogarithmic Scale

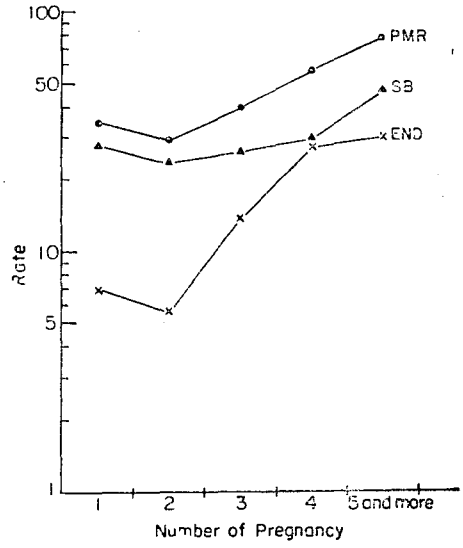

Fig. 2. Rates of SB, END and PMR by Frequency of Pregnancy in Semilogarithmic Scale.

period are also given in Table 6. The rates are lowest when gestational age is between

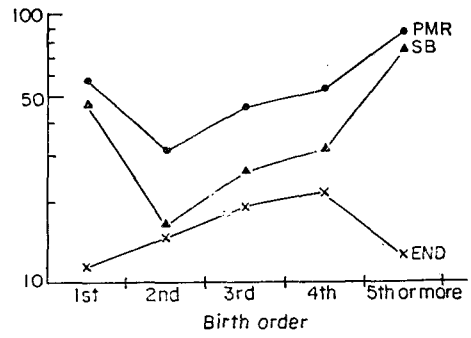

Fig. 3. Rates of SB, END and PMR by Birth Order in Semilogarithmic Scale

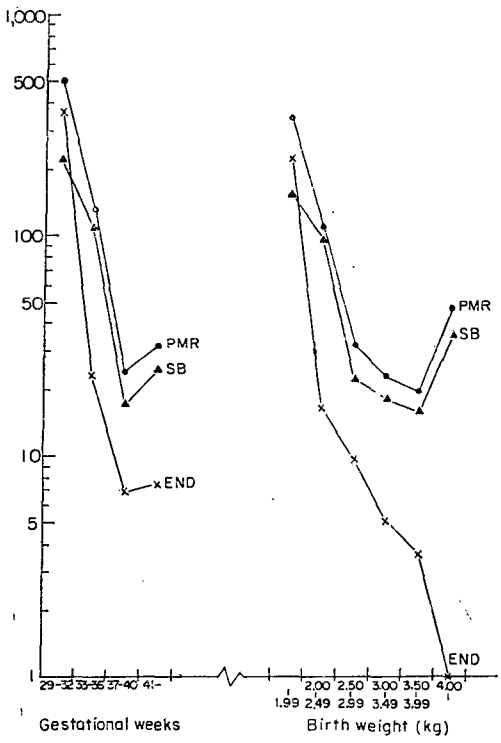

Fig. 4. Rates of SB, END and PMR by Gestational week in Semilogarithmic Scale

Fig. 5. Rates of SB, END and PMR by Birth weight in Semilogarithmic Scale

37 and completed 40 weeks. And the highest rates are at the 8th month of gestation. In this period the END rates exceed the rates of SB. The END rates markedly decrease with the gestational age until completed 40 weeks as compared with those of SB. The decrease of PMR up to completed 40 weeks is due to the falling in END, rather than due to in SB (Fig. 4)

Simultaneously, the PMR in relation to birth weight can be seen in the table and Fig. 5. The infants with of 1.99 Kg. or less in weight have the highest PMR. In those cases the END rates exceed those of SB. The PMR decline up to the birth weight of 3.00-3.49 Kg., mainly due to the falling in END. The rates of infants weighing over 4.00Kg. at birth are higher than those for 2.50-2.99Kg. And it may result from the rise of SB rates in this group.

The PMR in twin births becomes doubled or more compared to the rates in singletons (Table 6).

The END rates among the premature births reach to more than 20 times as high as those among the non-premature births reach(Table 7).

Table 7. Early Neonatal Deaths and Its Rate/ 1,000 Livebirths by the Prematurity.

Prematurity	Livebirth	END	Rate
Non-premature	2,204	15	6.8
Premature	143	21	146.8
Total	2,347	36	15.3

DISCUSSION

It has been well recognized by many authors that the outcome of the pregnancies in women of early young and older age is unfavorable against infant[7-12]. It was found that the perinatal mortality rates are high in teen-aged mothers and in the age of 35 years or greater. So, it takes for granted that these pregnancies have been labeled

"high-risk". A certain number of researchers have attempted to estimate the pure effects of maternal ageing on the perinatal loss[7, 8, 12-14]. Morrison speculated there were still considerable risks despite of careful prenatal care in the elderly primigravida[7]. Fischler et al have interpreted that the higher loss rates among women in the thirtes than among those in the twenties resulted from a progressive deterioration of the ability of individual women to bear children successfully[13]. On the contrary, Resseguie insisted it did not result from an age-caused increase in risk to individual women. Rather, it resulted from the continuing to become pregnant among "stillbirth-prone" women[8, 9]. In a large-scaled study[14], the percentage variable explained of maternal age to perinatal mortality proved only 0.63%. Since no adjustment is made in this study, there is limitation to estimate the ageing effect on the perinatal mortality. But the influence of maternal age on the perinatal mortality is less than other variables, and other factors which are concomitant with ageing phenomena, such as reproductive history, may affect this more effectively.

It is already accepted that multi-para or-gravida women had close bearing not only on mortality but on morbidity[8, 10, 12, 14, 15]. And it is well known that the mortality is higher in the first born than in the second born. A doubling of rates of perinatal death among the women with para 8 or over was reported[15]. Another worker speculated that the stillbirth was high in primigravida, whereas the early neonatal mortality rate increased regularly with the number of pregnancies[10]. Nevertheless, in this study the number of pregnancies affect significantly the perinatal mortality ($P=0.000$), while the effects of parity seem to be less significant ($P=0.07$). These observations can be interpreted to imply that: 1) It may be a consequence of the failure to adjust for other factors which are related to miscarriage. The mothers, constituted subjects of this study, experienced approximately one miscarriage on the average (Table 2). Daling et al found that the perinatal mortality was significantly higher in those with than in those without a history of one or more abortions when no adjustment was made [17]. These findings were completely consistent with the studies of other investigators[16]. 2) It may also result from the referring of high risk cases to large hospital. This inclination can confound the results analysed from hospital data.

Most of researchers reported and agreed that the birthweight is by far the most important determinant of perinatal mortality risk, particulary of the early neonatal survival[14, 19-23]. Elwood and McKenzie presented the percentage variable explained of birth weight among 13 significant variables to perinatal mortality was occupied 42.6%. Davarajan et al[20] studied the risk to early neonatal deaths by Yerushalmy's classification[21]. And he found that the "Light-for-date" babies were more vulnerable than the group IV, babies born before 37 weeks of gestation but with a birth weight of 2500 gm or more. In our study it is found that the birth weight with gestational age influence the early neonatal mortality, rather than stillbirth. And this results are consistent with the studies of Malan et al[19].

Since 1935 a premature infant has been defined as a liveborn weighing 2500 gm or less at birth. This definition was adopted by WHO in 1950, but its Expert Committee on MCH recommended that the term "prem-

ature" be used only for infants born less than 37 weeks after the beginning of the mother's LMP. Recently, however, the term of premature is used loosely, and the concept of this term changes to considering birth weight correlated by gestational age[20]. Agreed with this concept, the "prematurity" in this study is defined as liveborn before 37 weeks of gestation and with a birth weight of 2500 gm or less. The immaturity as a cause of early neonatal death occupies 61.1% (Table 2). And most of the leading cause of early neonatal death is found to be prematurity.

The mortality pattern of multiple births differs from that of singletons. In general the multiple pregnancies are certainly regarded as high risk pregnancies. But the increased incidence of deaths and morbidity in twin pregnancies was attributed to prematurity and to complications and diseases pertaining to prematurity, rather than to twinning per se.[25] And this findings proved true by other researchers[24, 26].

SUMMARY

The causes and problems underlying deaths in perinatal period are often similar and might be expected to yield to same type of preventive measures. This is one of the reasons for attempting to develop a reporting of perinatal mortality and its related matters. This study aims at figuring out the biologic risk factors onto the perinatal death.

Considering stillbirth and early neonatal mortality separately, considerable associations between stillbirth and reproductive history of women, are observed, and it is found that prematurity is the the far most important factor in the early neonatal mortality.

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—國文抄錄—

周産期死亡과 生物學的要因

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家族計劃事業이 主唱되고 採擇함에 있어 願한 妊娠을 滿足스러운 結果로 이끌어야 한다는 前題의 重要性은 아무리 强調해도 지나치지 않는다 하겠다. 따라서 危害한 妊娠을 일찍 發見하고 이에 對한 適切한 産前管理를 提供하는 것은 母子保健事業의 主要한 關心事이다. 더구나 韓國에 있어서 이러한 母子保健事業의 重要性이 政策立案者들에게 긍정적으로 인식되어진 것은 家族計劃이 國策의 하나로 採擇된지 거의 10年이 지난 후이었다는 것을 생각할 때 우리나라에서의 母子保健事業은 더욱 重要한 意味를 지닌다 할 수 있다.

母子保健狀態를 나타내 주는 여러가지 指標中에서도 周産期死亡率이 그 基本이 되는 것은 周知의 事實이다. 周産期에 일어나는 死亡의 基底에는 一聯의 共通된 要因들이 作用하고 있으며 고로 그 管理方法 또한 多樣하지 않아도 소기의 成果를 기대할 수 있다는 특징이 있다. 그러나 그러한 管理方案을 計劃樹立하는 데에는 周産期死亡에 關與되는 共通要因을 正確히 밝혀주는 統計資料가 必要로 하고 있다.

우리나라에 있어 周産期死亡에 關한 硏究는 그동안 매우 부진하였으며 이에 對한 資料 또한 거의 全無하다고 해도 과언은 아닐 것이다. 이에 本著者는 비록 限定된 資料이긴 하지만 病院分娩例를 中心으로 分析可能한 要因을 檢討하여 母子保健事業의 效果的인 遂行에 一抹의 方向을 提示하고져 本硏究를 시도하였으며 한편으로는 이 分野에 對한 硏究가 앞으로 보다 積極的으로 活潑하게 展開될 수 있기를 바라는 마음에서 若干의 知見이나마 이에 發表하는 바이다.

1973年부터 75年까지 滿 3年동안 서울大學病院에서 分娩된 2,421例를 硏究對象으로 하였으며 同期間에 發生된 周産期死亡과 이에 關聯된 生物學的 諸要因, 즉 母년령, 妊娠回數, 出産順位, 妊娠期間, 出産體重, 未熟兒여부, 雙生兒여부等과를 統計學的으로 cemputer에 依해 처리하였다.

얻어진 所見은 다음과 같았다.

1. 母年齡, 妊娠回數, 妊娠期間, 出産時體重等의 諸

要因은 周産期死亡에 對하여 統計的으로 有意한 영향을 미치고 있어 25~29歲의 년령군에서, 2번째 임신과 2번째의 出産에서 그리고 만삭의 임신 기간에, 出産時體重이 3.50~3.99kg 사이의 아이에서 그 周産期死亡率이 各各 가장 낮았다.

2. 死産과 初生兒死亡을 區分하여 고려해 볼때 死産은 母性의 妊娠歷과 매우 밀접한 관련이 있는 것으로 思料되었고 初生兒死亡은 未熟兒와 이에 관련된 병발이 거의 決定的인 原因이 된다고 思料되었다.

3. 周産期死亡率을 감소시키는 觀點에서의 母子保健事業은 未熟兒防止策과 出産은 母性의 적정년령기간 동안에 制限된 妊娠回數內에서 이루어 지도록 計劃되는 方向으로 모색됨이 妥當하다고 思料된다.