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Original Research Article

Maternal determinants affecting perinatal mortality: a multivariate statistical approach

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ABSTRACT

Background: India has made considerable progress over the last two decades in the area of maternal and child health, through innovative and comprehensive health packages that covers the spectrum of Reproductive Child Health (RCH). Awareness of the special vulnerability of the cohort of mothers with 'high risk factor' has led to the popular recognition of 'risk approach', involving the optimal use of existing MCH services, providing essential obstetrical care for all with early detection of complications and emergency services for those who need it, thus reducing the need for intensive care along with reduction in perinantal mortality. The objective was to assess the prevalence of various maternal risk factors in pregnant women in hospital admissions and their correlation with perinatal mortality.
Methods: The present study was carried out on 2050 consecutive deliveries from 1st April 2015 to 31st March 2016 at Department of Obstetrics and Gynecology and Department of Pediatrics, Muzaffarnagar Medical College, Muzaffarnagar Uttar Pradesh, India. All the pregnant women were interviewed and examined in detail at the onset of labor regarding various biosocio-economic characteristics, history of past and present medical and obstetrical complications.
Results: The PNMR (93.66/1000 birth) observed in present study was still at a higher level and comparable to that in other studies done by various authors in past in this region. A significantly higher PNMR was observed with increase in maternal age and parity (3 times higher PNMR at >35 years and 2 ½ times higher PNMR at parity >5). Similarly, medical illnesses (3 times higher PNMR) and obstetrical complications (1.5 times higher PNMR) during present pregnancy were showing significant effect on perinatal outcome. In a multivariate analysis, residence (rural /urban), place and number of antenatal visits, gestational age and type of delivery remained as most significant maternal risk factors ($p<0.005$) after multiple logistic regression of other factors viz. maternal age, height, weight, parity, education, socio-economic status and antepartum anemia.
Conclusions: It is heartening to observe that highest risk is associated with simple and easily identifiable factors like, unbooked cases, <3 antenatal visits, severe anemia, age >35 years, parity >5, weight <40 kg, height < 140cm , poor dietary calories, medical and obstetrical complications. These can identified from history only by grass root workers like traditional birth attendants and even elderly female family members. These risk determinants, labeled as simple but 'high' high risk are associated with poor perinatal outcome. If these factors are timely identified at community level and appropriately referred by grass root workers, it will significantly reduce perinatal mortality and improve neonatal survival.

Keywords: High risk approach, Maternal risk factors, Perinatal mortality, Neonatal mortality

INTRODUCTION

It is painful to know that even after advancement of medical science to a great extent, we in India still lose approximately 1 million out of 26 million infants born every year at a rate of 40/1000 live births. Approximately 70 % of these infants die within first 4 weeks in neonatal period (0.76 million) at a rate of 28/1000 live births and out of these roughly 80 % of neonatal deaths (0.6 million) occur within 1st week of their life in early neonatal period.[1,2]

India has made considerable progress over the last two decades in the area of maternal and child health, through innovative and comprehensive health packages that covers the spectrum of reproductive child health (RCH). Newborns however have missed out on the attention. The neonatal mortality rate (NMR) has declined at a slower pace compared to that of under-five mortality rate (U5MR). Despite the fact that maternal mortality has gone down considerably in recent past, perinatal mortality has attained a plateau at a higher level after a marginal decline over past two decades. Awareness of the special vulnerability of the cohort of mothers with 'high risk factor' has led to the popular recognition of 'risk approach'. The risk approach involves the optimal use of existing MCH services providing essential obstetrical care for all with early detection of complications and emergency services for those who need it, thus reducing the need for intensive care along with reduction in perinatal mortality.[3,4]

Periodical statistical information of the maternal risk factor provides a comprehensive idea of the magnitude of the problem, change in trend and effect of previous studies in the concerned community.

METHODS

With this view, the present study was carried out on 2050 consecutive deliveries from 1st April 2015 to 31st March 2016 at Department of Obstetrics and Gynecology and Department of Pediatrics, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India. All the pregnant women were interviewed and examined in detail at the onset of labor regarding various biosocio-economic characteristics, history of past and present medical and obstetrical complications.

The statistical analysis consisted of comparison and association of perinatal mortality with various biosocial, antenatal, intrapartum and postnatal variables.

A univariate analysis was done using 'EPI-INFO' software package designed by WHO, Geneva. Chi-square and fisher-exact tests were done as a test of significance of difference between various maternal risk factors and perinatal mortality.

Then risk factors showing statistically significant relation with outcome of delivery were selected for 'multivariate analysis' to assess their relation with perinatal mortality. The multivariate analysis was done using 'MULTLR' (multiple logistic regression by unconditional and conditional methods) software package designed by Epidemiology and Biostatistics unit of Ludwig Institute for cancer research- SP branch.

RESULTS

Out of total 2050 births registered, there were 1992 singleton deliveries (97.17%) and 58 twin deliveries (2.83%). Overall perinatal mortality rate (PNMR) was 93. 66/1000 births, comprising of Still birth rate of 59.03/1000 births and Early neonatal mortality rate of 34.63/1000 births). In twin pregnancies a perinatal mortality rate of 241.3/1000, still birth rate of 103.4 and early neonatal mortality rate of 137.9/1000 was observed. these values are approximately three times higher than singleton deliveries. Approximately 71% of total subjects were high risk mothers having perinatal mortality rate of 143.9/1000 as compared to perinatal mortality rate of 47.7/1000 in low risk mothers (Table 1).

Table 1: Basic information.

Characteristics	Number	Corresponding rate
Total birth registered after delivery	2050	NA
Singleton deliveries	1992	97.17 %
Twin deliveries	58	2.83 %
Still birth	121	59.03/1000 birth
Early neonatal mortality	71	34.63/1000 birth
Perinatal mortality	192	93.66/1000 birth
High risk mothers	1451	70.78 %

A highly statistically significant relation of increase in maternal age and parity was observed with higher perinatal mortality and morbidity. The safest age groups in terms of perinatal mortality (PNMR) and early neonatal morbidity (ENMB) were 25-29 and 20-24 years respectively. Similarly maternal weight <45 Kg and height <140 cm, maternal education (below high school), rural residence, occupation (non-skilled workers), low socio-economic status, poor dietary caloric/protein intake, anemia (especially at Hb% <10 gm% and very significantly below 7 gm%), short birth spacing (<3 years), all were found to be statistically significant in relation to higher perinatal mortality and morbidity (Table 2).

After multiple logistic regression, residence (rural /urban), place and number of antenatal visits, gestational age and type of delivery remained as most significant maternal risk factors ($p < 0.005$) after multiple logistic regression of other factors viz. maternal age, height, weight, parity, education, socio-economic status and antepartum anemia (Table 3).

Table 2: Univariate analysis.

Factor	+/-	Total No.	Perinatal Mortality		Odd's ratio	X^2	P value
			No.	Rate			
Age <20	+	113	9	80	0.83	0.28	0.599
	-	1937	183	94			
Age >35	+	108	28	260	3.79	36.8	0.000
	-	1942	164	84			
Parity	1	891	84	94	NA	9.64	0.008
	2-4	1088	94	86			
	≥ 5	71	14	197			
Religion (Hindu)	+	1759	161	92	0.85	0.66	0.416
	-	291	31	106			
Height <140 cm	+	102	20	196	2.52	13.26	0.000
	-	1948	172	88			
Weight <40 kg	+	168	30	179	2.31	15.54	0.000
	-	1882	162	86			
Residence (rural)	+	511	81	158	2.4	32.7	0.000
	-	1539	111	72			
Education	Illiterate+ prim	1307	158	128	2.21	7.93	0.005
	≥High school	239	14	59			
Diet calories (poor)	+	447	83	186	3.13	57.00	0.000
	-	1603	109	68			
Hb (gm/dl)	≤ 8.0	54	13	241	NA	31.59	0.000
	8.1-9.0	44	7	159			
	>9.0	1406	85	60			
Unbooked	+	817	157	192	8.3	153.4	0.000
	-	1233	35	28			
Anenatal visits	0	317	76	236	NA	166.7	0.000
	1-2	217	49	226			
	≥3	1516	67	44			
IFA Tablets	0-60	452	94	208	4.94	85.53	0.000
	≥120	990	50	50			
Bad Obstetric history	+	202	11	54	0.5	4.5	0.040
	-	1848	181	98			
Medical illness	+	67	17	254	3.5	20.9	0.000
	-	1983	175	88			
Obstetrical complication	+	1009	114	113	1.57	8.74	0.003
	-	1041	78	75			
Delivery type	Normal	1342	122	91	NA	3.16	0.205
	Forceps	144	9	62			
	Caesarean	564	61	108			

Table 3- Multiple logistic regression.

Factors	Coefficient	S.E	Z-score	P-value	O.R.	Lower	Upper
Residence	0.5738	0.1900	3.0194	0.0025	1.775	1.223	2.576
Maternal Age	-0.0338	0.0215	-1.5764	0.1149	0.967	0.927	1.008
Weight	0.0080	0.0145	0.5484	0.5834	1.008	0.980	1.037
Height	0.0075	0.0175	0.4260	0.6701	1.008	0.973	1.0430
Parity	0.0579	0.0815	0.7096	0.4779	1.060	0.903	1.243
Gestation	0.3068	0.0279	11.0122	0.0000	1.359	1.287	1.435
Education	0.0787	0.0940	0.8366	0.4028	1.082	0.900	1.301
Income	-0.0002	0.0002	-1.2208	0.2222	1.000	0.999	1.000
Occupation	0.1092	0.1780	0.6134	0.5396	1.115	0.787	1.581
AN visits	0.5049	0.0730	6.9215	0.0000	1.657	1.436	1.912
Place of ANC	-0.4078	0.0632	-6.4485	0.0000	0.665	0.588	0.753
Hb % (mother)	0.0182	0.0141	1.2947	0.1954	1.018	0.991	1.047
Delivery Type	-0.2899	0.0950	-3.0505	0.0023	0.748	0.621	0.902
Constant	-11.7089	2.5956	-4.5110	0.0000			

DISCUSSION

The PNMR (93.66/1000 birth) observed in present study was still at a higher level and comparable to that in other studies done by various authors in past in this region.[4-7]

The high PNMR found in present study was multifactorial, important reasons being:

- An extended PNMR was taken in this study as used by most of the authors[8] and national neonatology forum presently, thus including most of more preterms with poor survival rates (<30 % at <28 weeks).
- Higher percentage of still births (63.02 % of PNMR) due to, 70.78 % of high risk mothers in our study.
- Major portion of PNMR (81.77 %) was contributed by unbooked complicated emergency cases (approx. 40%).
- Almost a half of PNMR (42.19 %) was contributed by rural admission (1/ 4th of total cases).
- Again it is well known fact that statistics from large teaching hospitals though accurate, give a falsely high PNMR, as these hospitals have to treat serious and late referrals often from far off rural places.[9]

Evaluation of various maternal factors in relation to perinatal mortality

A significantly higher PNMR was observed with increase in maternal age and parity (3 times higher PNMR at >35 years and 2 ½ times higher PNMR at parity >5), as seen in other studies also.[2,10-16] However, in contrast to some other authors, there was only slightly higher PNMR (not statistically significant) in teenage mother (<20 year age) and primipara, as also supported by others.[2,4-7,16-19] The safest age group was found to be between 25-29 years of age, against 20-24 years in other studies.[10-16]

Six and half times higher PNMR was observed in unbooked cases than booked cases and no significance difference in PNMR was observed in mothers having 0 or 1-2 antenatal visits (5½ times PNMR than who took ≥3 antenatal Visits). Similarly 4 times higher PNMR was seen in mothers receiving <60 iron- folic acid tablets than who took >120 tablets.[2,5-7,15,16]

No significant relation of religion was observed with PNMR as against some previous studies.[14,20-23] While more than 2 times higher PNMR was observed in rural and in illiterate and even in primary educated mothers than in high school and above educated mothers.[13,15,16,22] A more than twice PNMR was found in mother having <40 kg weight and <140 cms height.[15,16]

Three times higher PNMR was seen in mothers having poor dietary calories (<2200 kcal/ day).[5,22] A 4 times higher PNMR was observed in mothers having Hb% ≤8 gm % and it reduced to 2½ times higher PNMR with only 1 gm % increase in Hb% (8.1-9.0 gm 5%).[7,10,12]

Similarly, medical illnesses (3 times higher PNMR) and obstetrical complications (1.5 times higher PNMR) during present pregnancy were showing significant effect on perinatal outcome.[3-7,10,15,16] While in contrast several studies past bad obstetric history (e.g. previous caesarean, abortion >2 and previous perinatal death) didn't show any statistically significant relation with poor perinantal outcome.[3-7,15,16] Forceps delivery showed slightly lower and caesarean slightly higher PNMR than normal delivery but it was not statistically significant.

In a multivariate analysis, residence (rural /urban), place and number of antenatal visits, gestational age and type of delivery remained as most significant maternal risk factors (p <0.005) after multiple logistic regression of other factors viz. maternal age, height, weight, parity, education, socio-economic status and antepartum anemia.

CONCLUSION

It is heartening to observe that highest risk is associated with simple and easily identifiable factors like, unbooked cases, <3 antenatal visits, severe anaemia, age >35 years, parity >5, weight <140 cms, poor dietary calories, medical and obstetrical complications. These can identified from history only by grass root workers like traditional birth attendants and even elderly female family members. These risk determinants, labelled as simple but 'high' high risk are associated with poor perinatal outcome. If these factors are timely identified at community level and appropriately referred by grass root workers, it will significantly reduce perinatal mortality and improve neonatal survival. Simple training of these grass root workers for identification of these simple but 'high' high risk determinants should form an integral part of I.E.C. (Information Education and Communication) activities.

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