International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Brahmanandan M et al. Int J Reprod Contracept Obstet Gynecol. 2017 Jun;6(6):2452-2458
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20172330

Original Research Article

Risk factors for perinatal mortality: a case control study from Thiruvananthapuram, Kerala, India

Mayadevi Brahmanandan[1]*, Lekshmi Murukesan[2], Bindu Nambisan[1], Shaila Salmabeevi[3]

[1]Department of Obstetrics and Gynecology, Medical college, Trivandrum, Kerala, India
[2]Department of Obstetrics and Gynecology, Sree Gokulam Medical College, Trivandrum, Kerala, India
[3]Department of Obstetrics and Gynecology, Medical college, TD Medical College, Alleppey, Kerala, India

Received: 25 March 2017
Accepted: 22 April 2017

***Correspondence:**
Dr. Mayadevi Brahmanandan,
E-mail: drbmaya@gmail.com

ABSTRACT

Background: The greatest risks to life are in its very beginning. Although a good start in life begins well before birth, it is just before, during, and in the very first hours and days after birth that life is most at risk. This prospective case control study was designed on maternal risk factors for perinatal mortality.
Methods: This was a case control study conducted in the Department of Obstetrics and Gynecology and Department of Paediatrics, Medical College Trivandrum for one year period in 2004-2005. The cases were all the fresh and macerated still births and early neonatal death cases during the study period. The controls were chosen as the next delivery entry in the OR register.
Results: During this period, the total number of deliveries was 14,796 and there were 431 perinatal deaths. The perinatal mortality rate was 29.12. This was much higher compared to Kerala's perinatal mortality rate of 10, the reason being that the study is conducted in a tertiary referral hospital with one of the best new born care nurseries and a large number of referrals. The most significant risk factors for perinatal mortality were low socio-economic status, referrals, late registration, prematurity, low birth weight, intra-uterine growth restriction, maternal diseases like gestational hypertension and gestational diabetes and intrapartum complications like abruption.
Conclusions: Perinatal mortality rate serves as the most sensitive index of maternal and neonatal care. Good antenatal care and prevention of preterm birth may play a key role in further reduction of PMR.

Keywords: Antenatal care, Early neonatal death, Perinatal mortality rate, Stillbirth risk factors

INTRODUCTION

The greatest risks to life are in its very beginning. Although a good start in life begins well before birth, it is just before, during, and in the very first hours and days after birth that life is most at risk. According to the World Health Organization (WHO), there are over 6.3 million perinatal deaths a year worldwide.[1] Of these, 2.64 million are stillbirths and 3.0 million are cases of early neonatal death. Newborn death now contributes to 40% of all deaths in children under five. Ninety-eight per cent of these deaths take place in developing countries.[2] Although perinatal period occupies less than 0.05% of the average lifespan deaths of babies during this period are as numerous as those in the next 11 months.

With the decline of infant mortality rate to low levels, perinatal mortality rate has assumed greater significance as a yardstick of obstetric and newborn care. Its value is that, it gives a good indication of the extent of pregnancy wastage as well as the quality of care available to both mother and newborn.

Perinatal mortality rate is calculated from the number of still-births and early neonatal deaths (those occurring in the first week of life) per 1000 total births (live births and still-births).

Definition of PNMR =Late fetal deaths ≥28 weeks+early NND within 7 days/Live births >1000 grams at birth. This definition follows the recommendations of the WHO in the tenth and ninth revisions of international classification of diseases. The vast majority of global perinatal deaths occur in the low- and middle-income countries. According to the 2014 SOIN report, the national PMR is 28/1000 (still-births 5/1000, early neonatal 23/1000) with marked inter-state variability (e.g. Kerala 10/1000 and Odisha 37/1000).[3] The currently prevalent maternal factors resulting in increased perinatal loss include adolescent pregnancies, maternal undernutrition, poor socioeconomic status, iron-deficiency anemia and other micro-nutrient deficiencies, inter-pregnancy intervals <12 months or >60 months, lack of antenatal care, maternal infections, pre-eclampsia and type-2 diabetes. The three major causes of neonatal deaths are complications from preterm birth (35%), infections (33%), and intra-partum related conditions or birth asphyxia (20%).[3]

METHODS

This was a clinical, non-interventional, case control study. The ratio of cases to controls was adjusted at 1:1. Patients delivered in SAT Hospital, Thiruvananthapuram with perinatal mortality and their controls were the study population. A period of one year between 2004-2005 was taken for the study.

Inclusion criteria

Those cases with perinatal losses which were included in the study, were babies with body weight above 1000 grams or gestational age above 28 weeks of gestation. The control was selected from those cases without perinatal loss, which comes next to each perinatal mortality case, in the labour register, at random.

Exclusion criteria

Birth weight <1 kg and Gestational age <28 weeks were excluded. Data was collected by using pre-designed questionnaire. It included a detailed history of the patient with special reference to socio-demographic factors like age, place of residence, occupation, educational status and family's income. Medical complications like heart disease, hypertensive disease, diabetes, jaundice and other diseases were taken into account. Obstetrical factors like parity, history of adverse perinatal outcome in the past, history of infertility, previous caesarean section, oligamnios, polyhydramnios, and growth restriction were considered. Details of labour and delivery like type of labour induction, type of presentation at delivery, type of anaesthesia used, colour of amniotic fluid, intra-partum problems are given special importance. Regarding the newborn, sex, body weight and APGAR are noted. Fetal factors like congenital anomalies were also considered in the study. Cause of perinatal death is analysed in detail. Care is taken to know whether the clinical condition in the mother is the cause for perinatal mortality. In this study, PMR is to mean the number of stillbirths starting from 28 weeks of gestation plus neonatal deaths in the first week of life per 1000 total births (PMR-I).

A newborn delivered with signs of life and died before the first week of life were counted as ENNDs. Gestational age was determined either from last normal menstrual period or from ultrasound report. Amenorrhea of 9 months was approximated to 40 weeks' gestation. The data was entered, coded and analyzed using SPSS version 16.0 computer software program. Binary logistic regression analysis was done at two stages-first for total cases (perinatal mortality) and then sub-group analysis for stillbirths and ENNDs with fixed controls. P-value < 0.05 was taken as statistically significant. Relevant information's were collected and Data was analyzed by using appropriate computer software. Ethical approval and clearance was obtained from the Human Ethical Committee, Medical College, Trivandrum.

RESULTS

During this period, the total number of deliveries were14,796 and there were 431 perinatal deaths. The perinatal mortality rate was 29.12. There were 202 macerated stillbirths, 50 fresh still births and 179 early neonatal death (Table 1).

Table 1: Perinatal death at a glance.

Parameters	Number	
Total live births	14,796	
IUD	202	47.12 %
Still birth	50	11.68 %
Early neonatal death	179	41.2 %
Total perinatal deaths	431	
Perinatal mortality rate	29.12	

Table 2: Causes/risk factors of early neonatal death.

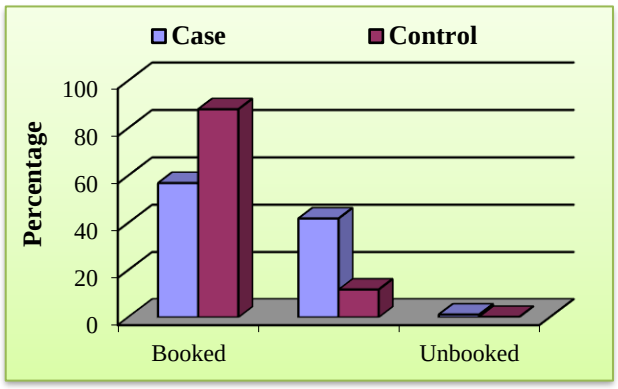
Causes	Number	
Prematurity	**79**	
Birth Asphyxia Extreme prematurity	40	
RDS, Prematurity	21	44.1%
Sepsis, prematurity	18	
Congenital anomalies	31	17.7%
Meconium Aspiration syndrome	25	13.9%
Placental insufficiency, Birth Asphyxia	15	8.3%
Term Birth Asphyxia	15	8.3%
Abruption	8	4.4%
Cord complication	6	3.3%
Total	179	100%

Of the 431 perinatal deaths, 386 were singletons and 45 were multiples. Table 2 shows the distribution of risk factors/causes of early neonatal death.

Table 3: Significant socio-demographic risk factors.

Risk factor	χ^2	P	OR	CI	
Socio-economic status	12.91	0.012	1.661	1.146	2.408
Education status	9.0	0.029	1.392	0.974	1.990
Referral status	100.357	0.000	5.537	3.887	7.886
Late registration	7.266	0.007	4.795	1.368	16.811
Birth interval	3.806	0.050	1.867	1.990	3.521

Socio-demographic risk factors found to be significant in the study is described in Table 3. Mean age of cases were 25.6 years and that of controls were 25.1 years. Maximum number of cases and controls were between 21-29 years. The two groups are statistically comparable with respect to age distribution. Association between place of residence and perinatal mortality has been found to be comparable in both groups. There are more number cases in low socio economic status group and the observation is statistically significant. Controls are generally better educated than cases and the observed difference is statistically significant. The study groups were comparable with respect to religion and caste. Nearly half of the cases are booked outside i.e. referred from outside. Referred cases have higher perinatal mortality rate and the observations is statistically significant (Figure 1).



χ^2=100.357; df-2; P-0.000

Figure 1: Referral status.

Patients with lesser number of antenatal visits are observed have an increased incidence of perinatal mortality and the difference is statistically significant. Controls generally have early antenatal registration than cases and the observed difference is statistically significant.

Table 4: Period of gestation.

	Case	%	Control	%
< 37 weeks	272	65.5	43	10.4
≥ 37	143	34.5	372	89.6
Total	415	100	415	100

Table 5: Distribution of maternal diseases in cases and controls.

	Cases	%	Control	%	χ^2	P value
No disease	277	66.7	326	78.6	---	---
Maternal disease present	138	33.3	89	21.4	14.559	0.000
G.HTN	90	21.7	39	9.4	23.87	0.000
Severe pre-eclampsia	41	9.8	10	2.4	20.07	0.000
Gestational DM	21	5.06	28	6.7	1.06	>0.05
GDM on insulin	17	4.09	6	1.44	5.411	0.020
Viral jaundice	9	2.5	2	0.5	-	
Epilepsy	5	1.2	5	1.2	-	-
Thyroid d/s	5	1.2	1	0.2	-	-
Severe heart disease	4	0.9	0	0	-	-
TORCH infections	4	0.9	-	-	-	-
Psychiatry	2	0.5	-	-	-	-
Asthma	1	0.2	-	-	-	-
Typhoid malaria	1	0.2	-	-	-	-
HIV+	1	0.2	-	-	-	-
ITP	1	0.2	-	-	-	-
APLA	1	0.2	-	-	-	-
Chicken pox	1	0.2	-	-	-	-
Morbid obesity	-	-	1	0.2	-	-

Perinatal mortality is comparable between primigravidas and multigravidas. Cases have more previous adverse pregnancy outcome than controls and the finding is statistically significant. Mean period of gestation of cases was 34.32 and that of controls was 38.25 (Table 4).

Prematurity is a significant risk factor for perinatal mortality with OR-16.455, and CI 11.309-23.943. 33% are term perinatal deaths where as 66% are preterm perinatal deaths. Non-vertex presentation had a higher perinatal mortality compared to vertex presentations and the observation was statistically significant. Most of the macerated stillbirths were preterm and in breech presentation and that may be the reason for this finding. There were more number of VBAC and assisted breech deliveries in the case group; especially for macerated stillbirths. Induction of labour does not have any bearing with perinatal mortality.

Table 6: Distribution of obstetric complications in cases and control.

Obstetric Complication	Cases	%	Control	%	χ^2	P value
IUGR	39	9.5	11	2.8	16.68	0.000
IUGR Oligamnios	23	5.5	17	4.1	0.94	>0.05
Mal-presentation	41	9.9	22	5.3	6.201	0.031
Fibroid Complicating	8	1.9	2	0.5	-	-
PROM	15	3.6	36	8.7	1.774	>0.05
PPROM	17	41	7	1.7	-	-
ROM>24 hours	6	1.4	1	0.2	-	-
AFLP	7	1.7	1	0.2	-	-
Cholestasis	2	0.5	1	0.2	-	-
Prolonged labour	12	2.9	3	0.2	9.456	0.002
APH/Placenta previa	12	2.9	3	0.7	-	-
Polyhydramnios	6	1.4	4	1	-	-
Multiple pregnancy	29	7	1	0.2	27.113	0.000

Table 7: Distribution of intra-partum complications.

	Cases	%	Control	%	χ^2	P value
No complication	302	72.8	356	86.0	-	-
Complications present	132	31.2	47	14.0	21.385	0.000
Abruption	41	9.8	3	0.7	34.655	0.000
Prolonged labour	12	2.9	7	1.7	9.456	0.002
Fetal distress	34	8.2	24	5.8	1.854	0.173
Maternal fever	14	3.4	4	1		
PPH	6	1.4	4	1		
Obstetric hysterectomy	4	1%	1	0.2		
DIC	5	1.2	2	0.5		
Rupture uterus	2	0.5	-	-	-	-
Scar dehiscence	-2	0.5	2	0.5	-	-
Placenta percreta/accreta	2	0.5	0	-	-	-
Maternal death	-1	0.2	0	-	-	-

Instrumental delivery and LSCS did not have any bearing with perinatal mortality. Maternal Anemia was not a significant risk factor for perinatal mortality. Patients with maternal diseases are more prone to have adverse perinatal outcomes. Gestational hypertension (GHTN) and Gestational Diabetes Mellitus (GDM) were having significant p value as risk factors for perinatal mortality. There were 41 cases of severe pre-eclampsia and 34 of them presented with macerated stillbirth. There were 7 cases of AFLP, 2 cases of obstetric cholestasis, 5 cases of epilepsy, 5 cases of thyroid disease, 4 cases of severe heart disease, 4 cases of TORCH infection, 2 psychiatry cases, and one each of chickenpox, malaria, APLA, ITP and HIV with perinatal losses (Table 5).

Patients with obstetric complications have a high chance for adverse perinatal outcome (Table 6). Foetal growth restriction and Abruptio placentae were significant causes for perinatal mortality. Multiple pregnancies were associated with a significant perinatal mortality. 99% of the multiple pregnancies with bad outcome were preterm. Adverse perinatal outcomes are very high in patients with

intra-partum complications like cord prolapse, meconium staining and the observed result is statistically significant. (Table 7).

Table 8: Distribution of birth weight between cases and controls.

	Case	%	Control	%
1-2 kg	301	69.5	35	8.7
2.1-2.4 kg	43	9.9	46	11.2
2.5-3.4 kg	78	18.6	278	66.9
>3.5 kg	9	2.0	55	13.2
Total	431	100	415	100

Low birth weight was a significant risk factor for perinatal mortality (Table 8). Congenital anomalies are found to be a significant risk factor for perinatal mortality. 72 (16.4%) of the 431 deaths had been due to congenital anomalies. 12.3% of macerated stillbirths, 30% of fresh stillbirths and 17.9% of early neonatal deaths were complicated by congenital anomalies.

CNS anomalies are the common anomalies found in perinatal deaths. 95% of early neonatal deaths were on day one. Though there are an increased number of male perinatal losses, the difference is not statistically significant. The significant obstetric risk factors are outlined in Table 9.

Table 9: Significant obstetric risk factors.

	χ^2	P value	OR	CI	
Adverse pregnancy outcome	4.894	0.027	1.508	1.046	2.175
Prematurity	268.30	0.000	16.455	11.309	23.943
Mal-presentation	6.201	0.031	1.958	1.145	3.350
Maternal disease	14.559	0.000	1.825	1.337	2.490
Gestational hypertension	23.87	0.000	2.67	1.782	3.999
Gestational diabetes	5.411	0.020	2.912	1.136	7.460
Obstetric complications	18.926	0.000	1.787	1.374	2.323
Preterm labour	26.6	0.000	7.271	3.048	17.346
IUGR	16.68	0.000	3.809	1.923	7.541
Multiple pregnancy	27.113	0.000	31.104	4.217	229.411
Intra-partum complications	21.385	0.000	2.861	1.656	4.942
Abruption	34.655	0.000	20.213	4.839	84.438
Low birth weight	305.031	0.000	15.507	11.121	21.622
Congenital anomalies	45.260	0.000	6.752	3.605	12.645

DISCUSSION

This study demonstrated that the PMR was nearly two-fold of the state PMR estimated for 2005.[4] This is probably because most of the mothers of the cases in this study and other hospital based studies came referred very late and with serious obstetric complications.[5,6] As a result, such hospital based perinatal death studies may not reflect, but may overestimate the actual perinatal mortalities at the community level, due to selective referral bias.[7,8]

In a similar study by Bai NS et al in the same hospital between 1986-87, the PMR was 42.75.[9] The leading causes of death were birth asphyxia (31.28%), prematurity (15.6%), congenital malformations (8.4%), and infections (7.2%). The trends have changed in 15 years and in the present study, when subjected to multivariate analysis, only prematurity and low birth weight were found to be highly significant. This reflects the quantum leap in maternal and child health care in Kerala. This remarkable finding is in concordance to many other studies from the developed nations.Nearly two-third of the total perinatal deaths were preterm, and the association of preterm delivery with higher rate of perinatal mortality is well noted in several studies.[10-13] Lucy D et al in their study from Orissa, described that prematurity accounted for 42.5% of perinatal mortality rate.[15] Ravikumar et al in his study on stillbirth rate in a tertiary care hospital, described that 74.6% were low birth weight and 48.4% were preterms.[16] Ashton in his study states that in conjunction with low birth weight, prematurity has been the leading cause of neonatal death in African-American newborns.[17]

Mukherjee SB et al in their recent study described that the socio-demographic factors resulting in increased perinatal loss include adolescent pregnancies, maternal undernutrition, poor socioeconomic status, iron-deficiency anemia and other micro-nutrient deficiencies, inter-pregnancy intervals <12 months or >60 months and lack of antenatal care.[18] Present study had similar findings. But the exceptions to be noted are that iron deficiency anemia and adolescent pregnancies were not found to be significant risk factors for PMR in our study. Shah D and co-workers in their perinatal audit for FOGSI

described a 7-fold increase in the risk of perinatal death in the presence of an obstetric complication, irrespective of its nature.[19] In this study, the common obstetric complications associated with preterm births were G.HTN, Preterm labour, APH, Multiple Pregnancy and PROM which altogether contributed for about two third of all preterm births. Shah D et al described that hypertension in the mother increases perinatal mortality by 4.76 times.[19] Ravikumar et al, described that PET accounted for 18.9% of stillbirths.[16] Das Lucy et al described that PET accounted for 21.9% of stillbirths.[15]

Kuti O et al reports that the high incidence of multiple pregnancies and low birth weight babies are one of the main reasons for the high perinatal mortality rates in Nigeria.[20] Abu-Heija[21] in his study reported abruption as a leading cause of fetal death.[21] Similar observations were made by Duru Shah.[19] Ravikumar et al, in his study, reported that 10.3% of stillbirths had congenital malformations and neural tube defects were the commonest which is similar to the findings of the present study.[16]

CONCLUSION

Improvement of maternal and child health care especially with regard to registration of all pregnant mothers, early identification of high risk cases and timely intervention is the need of the hour. This can be achieved by adequate antenatal visits, promotion of small family norms, nutritional supplementation, appropriate intrauterine monitoring and conduction of delivery by trained personnel along with advanced life support for the sick newborn.

ACKNOWLEDGMENTS

Authors are deeply indebted to Dr. Sheela T Shenoy, Retd. Professor and Head of the Department, O and G for her keen interest, constant encouragement and valuable suggestions given throughout this study. Authors also express profound gratitude and deep regards to Dr. Santhosh Kumar. S, Professor, Department of Paediatrics, Govt. Medical College, Trivandrum for his exemplary guidance, monitoring and constant encouragement throughout the course of the study.

Authors also express deep sense of gratitude to Dr. Nirmala C, Professor and Head of Department of Obstetrics and Gynaecology for her support and guidance. Authors wish to express their gratitude to Dr. P. K. Babu, Asst. Professor, statistics and Demography for helping us with the analysis. Authors thank other staff members of the department who rendered their help in this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization, author. Neonatal and perinatal mortality: country, regional and global estimates. Geneva, Switzerland; 2006.
2. Cousens S, Blencowe H, Stanton C, Chou D, Ahmed S, Steinhardt L et al. National, regional, and worldwide estimates of stillbirth rates in 2009 with trends since 1995: a systematic analysis. Lancet. 2011;377(9774):1319-30.
3. Public Health Foundation of India, All India Institute of Medical Sciences, Save the Children. Zodpey S, Paul VK, editors. State of India's Newborns (SOIN) 2014- A Report. New Delhi: PHFI, AIIMS, SC;2014.
4. National Family Health Survey-3: Summary of findings. Available from: http://www.nfhsindia.org.
5. Sahle-Mariam Y, Berehane Y. Neonatal mortality among hospital delivered babies. Ethiopian J Health Dev. 1997;11(3):279-85.
6. Berhan Y, Abdela A. Emergency obstetric performance with emphasis on operative delivery outcome: Does it reflect the quality of care? Ethiopian J Health Dev. 2004;18(2):96-106.
7. Naey RL, Dozor A, Tafari N, Ross SM. Epidemiological features of perinatal deaths due to obstructed labour in Addis Ababa. Brit J of Obstet Gyncol. 1977;84:747-50.
8. Kidanto HL1, Mogren I, van Roosmalen J, Thomas AN, Massawe SN, Nystrom L et al. Introduction of a qualitative perinatal audit at Muhimbili National Hospital, Dar es Salaam, Tanzania. BMC Pregnancy Childbirth. 2009;9:45.
9. Bai NS, Mathews E, Nair PM, Sabarinathan K, Harikumar C. Perinatal mortality rate in a south Indian population. J Indian Med Assoc. 1991;89(4):97-8.
10. Daniel B, Hakim LY. Still birth at Tikur Anbessa Hospital a retrospective study. Ethiopian J Health Dev. 2008;2(15):25-34.
11. Callaghan WM, MacDorman MF, Rasmussen SA, Qin C, Lackritz EM. The contribution of preterm birth to infant mortality rates in the United States. Pediatrics. 2006;118(4):1566-73.
12. Cifuentes J, Bronstein J, Phibbs CS, Phibbs RH, Schmitt SK, Carlo WA. Mortality in low birth weight infants according to level of neonatal care at hospital of birth. Pediatrics. 2002;109(5):745-51.
13. Central statistics agency, author. Ethiopia Demographic and health survey (EDHS) Addis Ababa, Ethiopia: CSA; 2005. Available from: www.measuredhs.com/pubs.
14. Barros FC, Bhutta ZA, Batra M, Hansen TN, Victora CG, Rubens CE. the GAPPS Review Group, author. Global report on preterm birth and stillbirth (3 of 7): evidence for effectiveness of interventions. BMC Pregnancy Childbirth. 2010;10(1):S3.
15. Lucy D, Umakant S, Niharika P:Perinatal mortality in a referral hospital of Orissa: A 10 year review. J Obstet Gynecol India. 2005;55(6):517-20.

16. Ravikumar M, Devi A, Bhat V, Asha O. Analysis of stillbirth in a referral hospital. J Obstet Gynaecol Ind. 1996;46(6):791-6.
17. Ashton D. Prematurity-infant mortality: the scourge remains. Ethn Dis. 2006;16(2 Suppl 3):58-62.
18. Mukherjee SB, Bandyopadhyay T. Perinatal mortality-what has changed? Indian Pediatr. 2016;53:242-3.
19. Shah D. Perinatal Audit. A report produced by the perinatology committee of the FOGSI. 1998
20. Kuti O, Orji EO, Ogunlola IO. Analysis of perinatal mortality in a Nigerian teaching hospital. J Obstet Gynaecol. 2003;23(5):512-4.
21. Abu-Heija AT. Causes and factors affecting perinatal mortality at Princess Basma Teaching Hospital in North Jordan. Asia Oceania J Obstet Gynaecol. 1994;20(4):415-8.

Cite this article as: Brahmanandan M, Murukesan L, Nambisan B, Salmabeevi S. Risk factors for perinatal mortality: a case control study from Thiruvananthapuram, Kerala, India. Int J Reprod Contracept Obstet Gynecol 2017;6:2452-8.