Perinatal mortality attributable to complications of childbirth in Matlab, Bangladesh

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Very few population-based studies of perinatal mortality in developing countries have examined the role of intrapartum risk factors. In the present study, the proportion of perinatal deaths that are attributable to complications during childbirth in Matlab, Bangladesh, was assessed using community-based data from a home-based programme led by professional midwives between 1987 and 1993. Complications during labour and delivery — such as prolonged or obstructed labour, abnormal fetal position, and hypertensive diseases of pregnancy — increased the risk of perinatal mortality fivefold and accounted for 30% of perinatal deaths. Premature labour, which occurred in 20% of pregnancies, accounted for 27% of perinatal mortality. Better care by qualified staff during delivery and improved care of newborns should substantially reduce perinatal mortality in this study population.

Keywords: Bangladesh; infant mortality; labour, premature; labour complications; mortality.

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Introduction

Mortality rates among under-5-year-old children have decreased substantially over the past 20 years in developing countries, but perinatal mortality has not followed the same pattern and continues to present a huge burden. In 1995, WHO estimated the number of perinatal deaths worldwide to be greater than 7.6 million, with 98% of these deaths occurring in developing countries (*1*). In Africa, perinatal mortality rates as high as 75 per 1000 births have been reported; estimates for Asia are in the range 36–74 per 1000 births (*1*).

Studies carried out in both developed and developing countries have identified several risk factors for perinatal mortality. Perinatal deaths are largely the result of poor maternal health, adverse social conditions, and inadequate care during pregnancy, delivery, and the immediate postpartum period (*2*). Strategies to improve perinatal health include prevention and treatment of pregnancy complications such as infections (particularly syphilis) and hypertension, adequate nutrition during pregnancy, improved care at delivery, and better care of neonates (*2–5*). Ensuring that all deliveries are supervised by a trained attendant has now become the cornerstone of safe motherhood programmes (*6*).

Complications during childbirth have long been known to increase the risk of perinatal death. During the 1960s in Norway, for example, perinatal mortality rates after uterine rupture and placenta praevia were, respectively, as high as 216 and 99 per 1000 (*7*). In a hospital-based case–control study in Saudi Arabia, complications during labour increased the risk of perinatal death fivefold (*8*). Although perinatal deaths associated with dystocia are now relatively rare in industrialized countries, they are still substantial in many developing countries. In Guatemala, up to 87% of babies have been reported to have died during deliveries complicated by abnormal fetal position (*9*). In India, breech delivery accounted for 19% and 12% of stillbirths and neonatal deaths, respectively, and birth asphyxia led to 41% of early neonatal deaths (*10*). WHO has estimated that birth asphyxia and birth injuries may account for up to one-third of neonatal deaths, but the epidemiological evidence to support this claim is scant (*2*).

Very few of the population-based studies of perinatal mortality in developing countries have considered intrapartum risk factors (*9–11*). Most workers have examined the place or type of delivery rather than the complications per se (*3, 4, 12*). In view of the current emphasis on improving the care given during labour and delivery to reduce maternal mortality, it is important to assess the extent to which this approach may also contribute to the reduction of perinatal mortality.

The present study assessed the proportion of perinatal deaths that are attributable to complications during childbirth in Matlab, Bangladesh. Since deliveries complicated by maternal pathology may be partly associated with preterm labour and with complications during pregnancy, we have separated the effects of complications during childbirth from those associated with premature labour and with those detectable antenatally.

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Methods

The study was conducted in Matlab, a rural area in Bangladesh that has been under continuous demographic surveillance since 1966 (*13*). Major demographic events such as births, deaths and marriages are recorded during monthly home visits by community health workers and the completeness of reporting is high (*13*). Since October 1977, part of the area — with a population of approximately 100 000 — has been covered by a maternal and child health and family planning (MCH–FP) programme. A community-based maternity care programme was introduced in part of the MCH–FP area in 1987 and expanded to the entire area in 1990 (*14, 15*). A maternity clinic was established in Matlab town, professional midwives were posted in the villages, and transport for emergency cases was provided. Midwives visited the women at home, providing antenatal care, delivery assistance and postnatal care.

The study covered all the women who were seen by a midwife antenatally and during childbirth between 1987 and 1993. Women whose pregnancy had lasted for less than 28 completed weeks were excluded. Detailed methods have been outlined elsewhere (*16*). Briefly, for each pregnant woman, the midwife kept a card covering the antenatal, delivery and postpartum period. Data on women admitted to the Matlab clinic were also available from the maternity ward register. During antenatal visits, the midwives recorded socio-demographic, anthropometric and medical factors. Any maternal pathology discovered during pregnancy, labour or delivery was registered and treated (*16*).

The cut-off points for the antenatal markers were chosen based on the proportion of women in the risk groups or on cut-offs used in other studies. Maternal age was divided into three groups: $\leqslant$ 18 years, 19–34 years, and $\geqslant$ 35 years. Primiparity and parity $\geqslant$ 6 were considered as risk markers. Poor obstetric history included women who reported a previous stillbirth, abortion, caesarean section or obstructed labour. The cut-off for height of 144 cm was chosen to represent the 10% of women with the lowest height (10th percentile). For upper-arm circumference (MUAC), both women below the 10th percentile ($\leqslant$ 202 mm) and beyond the 90th percentile ($\geqslant$ 250 mm) were considered at risk. Maternal weight was classified by gestational age, and women whose weight was below the 10th and 20th percentile and above the 90th percentile were categorized separately. Anaemia (diagnosed clinically), oedema, proteinuria, fever, jaundice and vaginal bleeding were categorized as binary variables. Pre-eclampsia was defined as a diastolic blood pressure of $\geqslant$ 90 mmHg with moderate-to-severe tibial oedema or proteinuria. If the woman made more than one antenatal visit, she was considered at risk if she presented a risk factor during any of the visits.

Preterm delivery was defined as the birth of an infant with a gestational age of less than 37 completed weeks (i.e. less than 259 days). Gestational age was calculated from the date of the last menstrual period (recorded during monthly visits for women who reported to be amenorrhoeic). Complications during delivery were registered as diagnosed by the midwives or as noted in the maternity register. Data on perinatal deaths were obtained from the demographic surveillance system. A perinatal death was defined as the death of a fetus after 28 weeks' gestation or of a neonate during the first seven days of life. For twins, the outcome was classified as a perinatal death if at least one of the twins died in the perinatal period. Repeating the analysis excluding twins did not significantly alter the findings (data not shown).

Data were analysed using Stata 5 software. Associations with perinatal mortality were expressed as odds ratios (OR) with their 95% confidence intervals (CI). To control for confounding, all potential risk factors were incorporated into a logistic regression model, and a backward selection (at $P = 0.10$) was used to arrive at the final model. The population-attributable fraction (PAF) was calculated for the variables included in the final model, based on the adjusted odds ratios and the prevalence of the risk factor among the exposed (*17*). The PAF is interpreted as the proportion of perinatal deaths that could be avoided if the risk factor is controlled or eliminated in the population, after adjusting for other risk factors (*18*).

Results

Between 1987 and 1993, 10 464 (61.6%) of the 17 000 pregnant women residing in the area covered by the maternity care programme had been in contact with a midwife during the antenatal period or during labour, or both. There was no difference in the perinatal mortality rates between those who had been in touch with the programme and those who had not (perinatal mortality: 60.2 and 58.3 per 1000, respectively; OR = 1.03 (95 % CI = 0.91–1.18)). Among those who had been in touch with a midwife, 3909 had received both antenatal and delivery care, 3854 of whom were after 27 weeks' gestation. The perinatal mortality rate was 71.4 per 1000 births. This rate was significantly higher than that observed among women who had received either antenatal or delivery care from a midwife, but not both (perinatal mortality: 48.4 per 1000 births; OR = 1.51 (95% CI = 1.28–1.79)).

The prevalence and perinatal mortality rates associated with childbirth complications are shown in Fig. 1. More than half of the women diagnosed with an obstructed labour or an abnormal fetal position lost their babies during or shortly after the pregnancy, although such complications were rarely reported by the midwife (0.9% and 0.3%, respectively). Eclampsia and pre-eclampsia were associated with very high perinatal mortality rates (323 and 152 per 1000, respectively), as were breech presentation (375),

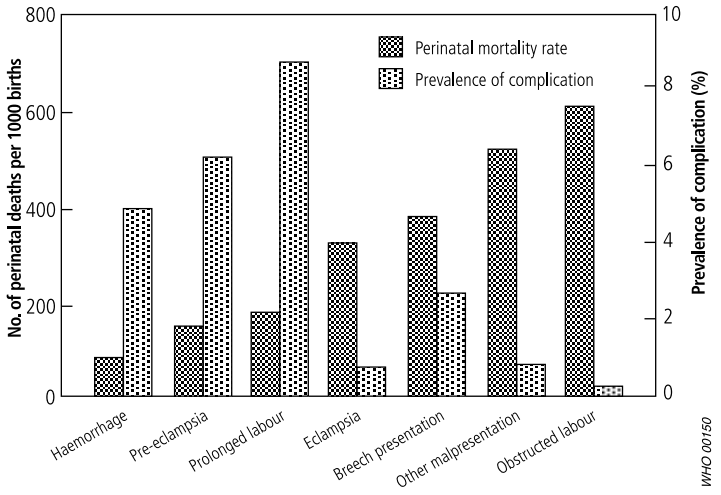
prolonged labour (181), multiple pregnancy (215), and intrapartum haemorrhage (103). Women without any of the above childbirth complications had a perinatal mortality rate of 48 per 1000.

The main risk factors of perinatal death are shown in Table 1. After controlling for all the factors studied, the demographic and nutritional markers that were significantly associated with perinatal mortality were young maternal age ($\leqslant$ 18 years), a bad obstetric history, an upper-arm circumference of $\geqslant$ 250 mm, and thinness of the mother (weight $\leqslant$ 10th percentile for gestational age). The antenatal signs and symptoms significantly associated with perinatal death were pre-eclampsia and jaundice (Table 1). Premature labour increased the risk of perinatal death fourfold (OR = 3.82). The complications during delivery that were linked to high perinatal mortality were breech presentation (OR = 8.3), other abnormal fetal positions (OR = 16.5), prolonged labour (OR = 2.5), obstructed labour (OR = 26.4), and eclampsia (OR = 7.9).

Population-attributable risk percentages for each of the factors associated with perinatal mortality are shown in Fig. 2. Prematurity alone accounts for 29% of perinatal deaths, followed by bad obstetric history (15%), prolonged labour (13%), and breech presentation (13%). All other factors accounted for fewer than 7% of deaths.

To obtain an estimate of the potential contribution of all factors detectable during pregnancy, and all complications during labour and delivery, we grouped women into those having any of the six antenatal markers found to be associated with perinatal death, those with a premature birth, and those with an abnormal fetal position (breech or other), eclampsia or prolonged/obstructed labour, and repeated the analysis (Table 2). Women with any of the six antenatal markers had a twofold increased risk of perinatal death, accounting for 26% of perinatal mortality. Prematurity increased the risk threefold and accounted for 27% of perinatal mortality. Complications during labour and delivery, although the least common (12%), increased the risk fivefold and accounted for 30% of perinatal deaths. Dystocia alone (any malpresentation or prolonged/obstructed labour) increased the risk fivefold and accounted for 26% of perinatal mortality.

Fig. 1. **Prevalence of perinatal deaths and childbirth complications in Matlab, 1987–93**



Discussion

Complications of childbirth and premature delivery each accounted for nearly a third of perinatal deaths in this population. Although the high contribution of such factors may in part reflect the self-selection of women with delivery complications, the size of the relative risks clearly corroborates their importance as determinants of perinatal mortality. In this population, improved delivery care by qualified staff and better care of neonates should substantially reduce perinatal mortality.

Since the population studied here was selected for higher than average perinatal mortality, we may have overestimated the population-attributable fractions. Indeed, women may be more likely to call the midwife when a problem occurs, and the prevalence of delivery complications — hence the population-attributable fractions — may have been overestimated. Other biases are unlikely to explain the findings, however. The ascertainment of perinatal deaths is nearly complete in Matlab, and it is unlikely that we have missed pregnancies extending after 28 weeks' gestation. Estimation of gestational age on the basis of menstrual dates may be subject to error (*19*), but since this error is likely to be non-differential, it would have led to an underestimation of the odds ratios. The equivocal nature of entities such as 'dystocia' or 'prolonged labour' is well known (*20*), and the midwives, although well-trained, may have misclassified some cases of dystocia. As with gestational age, however, the latter would have induced an underestimation of relative risks, biasing the population-attributable fractions downwards.

The relatively small contribution to perinatal mortality of factors detectable antenatally, such as maternal thinness or anaemia, may be partly explained by the low attendances for antenatal care, the nature of the factors studied, and specific features of this population. First, the majority of the women attended antenatal care only once around the 7th and 8th month of pregnancy (*16*), and we may have missed pathologies that occurred at other times. Second, the midwives mostly relied on clinical assessments during home visits, and diagnoses requiring laboratory or other facilities may have been missed. Severe anaemia, for example, has been shown to be associated with perinatal mortality (*10*), and the lack of an association in this study may in part be due to misclassification of the clinical diagnosis. Screening for syphilis during pregnancy, although not ascertained in this study, has been deemed a useful strategy at the public health level in

Table 1. **Prevalence, crude odds ratios and adjusted odds ratios for selected risk markers of perinatal death among 3865 pregnancies, Matlab, Bangladesh, 1987–93**

Risk markers	Prevalence (%)	Crude odds ratio	Adjusted odds ratio[a]
Demographic markers			
Maternal age			
⩽ 18 years	6.4	1.59 (1.03–2.45)[b,c]	1.61 (1.00–2.59)[c]
⩾ 35 years	9.0	1.42 (0.96–2.09)	–
Parity			
0	32.6	1.22 (0.94–1.58)	–
⩾ 6	6.4	1.40 (0.88–2.23)	–
Poor obstetric history[d]	20.6	1.95 (1.50–2.55)[e]	1.90 (1.42–2.55)[e]
Antenatal nutritional markers			
Height ⩽ 144 cm	10.8	1.54 (1.09–2.18)[c]	1.46 (0.99–2.15)
Upper -arm circumference			
⩽ 202mm	11.8	1.30 (0.90–1.87)	–
⩾ 250mm	9.7	1.51 (1.04–2.20)[c]	1.92 (1.28–2.89)[e]
Not specified	5.9	1.14 (0.68–1.90)	–
Weight			
⩽ 10th percentile for GA	9.9	1.60 (1.08–2.38)	1.64 (1.07–2.51)[c]
11th–25th percentile for GA	9.6	1.40 (0.93–2.18)	1.51 (0.98–2.32)
⩾ 90th percentile for GA	8.6	1.37 (0.89–2.12)	–
Not specified	29.8	1.05 (0.77–1.43)	–
Signs and symptoms in pregnancy			
Moderate and severe anaemia	2.8	1.69 (0.91–3.12)	–
Pre-eclampsia[f]	1.5	3.06 (1.57–5.97)[e]	2.41 (1.13–5.10)[c]
Fever	2.2	2.38 (1.30–4.36)[e]	–
Jaundice	1.2	3.99 (2.01–7.91)[e]	3.38 (1.62–7.04)[e]
Vaginal bleeding	0.4	3.94 (1.08–14.39)[e]	–
Length of gestation			
28-36 weeks	20.0	3.44 (2.63–4.50)[e]	3.82(2.84–5.12)[e]
⩾ 42 weeks	11.0	1.34 (0.87–2.06)	1.51 (0.96–2.38)
Unspecified	2.8	2.24 (1.17–4.29)[e]	2.78 (1.37–5.65)[e]
Complications during labour			
Multiple pregnancy	1.7	3.71 (2.03–6.79)[e]	-
Fetal presentation breech	2.7	9.58 (6.37–14.66)[e]	8.34 (5.27–13.19)[e]
Other abnormal	0.9	16.97 (8.32–33.48)[e]	16.52 (7.57–36.09)[e]
Pre-eclampsia	6.3	2.53 (1.74–3.68)[e]	–
Eclampsia	0.8	6.39 (2.98–13.72)[e]	7.89 (3.32–18.75)[e]
Labour prolonged	8.7	3.52 (2.58–4.80)[e]	2.52 (1.76–3.61)[e]
Obstructed	0.3	23.80 (6.66–84.99)[e]	26.41 (6.64–105.03)[e]
Intrapartum haemorrhage	5.0	1.37 (0.83–2.26)	–

[a] Adjusted for all other factors (demographic and nutritional markers, signs and symptoms in pregnancy, length of gestation and complications during labour).

[b] Figures in parentheses are 95% confidence intervals.

[c] $P<0.05$.

[d] Poor obstetric history included a history of stillbirth, abortion, caesarean section and obstructed labour.

[e] $P<0.01$.

[f] Pre-eclampsia during pregnancy was defined as diastolic blood pressure ⩾ 90 mmHg and moderate/severe tibial oedema or proteinuria.

Matlab (*21*). Lastly, the surprisingly weak association for nutritional factors may be related to the unusual thinness of the women in Matlab (*22*). At 7 months' gestation, the pregnant women weighed an average of 46 kg, and the average overall weight gain during pregnancy was only 5 kg (*23*). The lack of heterogeneity in nutritional status across women in Matlab may preclude the accurate assessment of the adverse effects of maternal thinness on perinatal health.

The high risks of perinatal mortality associated with pre-eclampsia and twin pregnancy strengthen previous suggestions that screening for blood pressure and twin pregnancies may be one of the

key components of antenatal care in settings where women seek such care late in pregnancy (*16*). Previous research in Matlab has shown that a single high blood pressure measurement late in pregnancy will identify a large proportion of women who will develop pre-eclampsia/eclampsia during labour and delivery, and that midwives can ascertain a large proportion of twin pregnancies through the measurement of fundal height. Although it is unlikely that the midwife can adequately manage such complications in the woman's home, early detection and referral to higher levels of care will certainly prevent some of the adverse events.

The contribution of preterm delivery to perinatal mortality is well known (*24*). The rate of preterm delivery (20%), however, was unusually high, particularly as gestational ages before 28 weeks were excluded, and as elective actions to end labour prematurely are not commonly performed in this rural population. The preterm delivery rates reported in the literature are much lower, ranging from 6% in Europe to 11% in North America, although rates as high as 19% have been reported for black Americans (*24, 25*). Women who called a midwife during labour had similar rates of prematurity as women delivering at home without the help of a midwife (data not shown), and it is unlikely that we have overestimated the rate of preterm labour.

The perinatal mortality rates reported here are slightly lower than those reported for the MCH–FP area in previous years (*26, 27*). The declining trends in perinatal mortality appear to have been sustained — falling from 80 per 1000 in 1979–82 to 69 and 60 per 1000 in 1983–86 and 1987–93, respectively. The earlier decline had been mostly attributed to tetanus toxoid immunization of the mothers, possibly enhanced by iron supplementation and treatment of infections during pregnancy (*26*). Whether the care provided by the midwives contributed to the further decline is difficult to establish, as other — unknown or unmeasured — factors affecting perinatal health may have coincided with the introduction of the maternity care programme in Matlab (*15*).

The high perinatal mortality rates associated with dystocia are worrying, particularly in a context of midwife-assisted deliveries. As shown in Sweden, midwives have a major role to play in the management of labour complications during home deliveries (*28*). The partograph, an effective tool for the early recognition of prolonged or obstructed labour, has been promoted for use at health centres and hospitals (*2*), and there is no reason why it should not be used by midwives in the community. For birth asphyxia, a common complication of prolonged and obstructed labour or prematurity, resuscitation will be life-saving (*2, 29, 30*). Thermal protection of the newborn using simple approaches such as skin-to-skin contact and kangaroo-mother care will also save lives (*31*). Efforts to improve the training of midwives in labour management and care of neonates, supported by effective referral mechanisms, will contribute to substantial reductions in perinatal mortality. ■

Fig. 2. **Population-attributable riks for perinatal mortality in Matlab, 1987–93** (MUAC = mid-upper arm circumference)

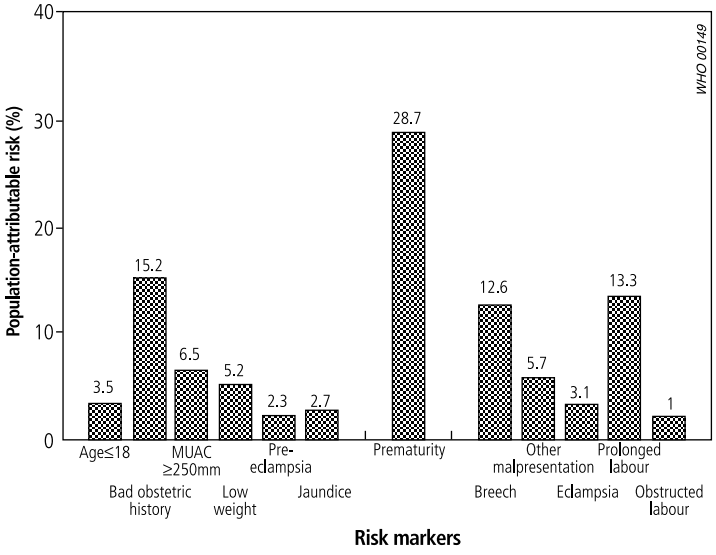


Table 2. **Prevalence, odds ratios and population attributable risk percent for antenatal markers, prematurity and labour complications, Matlab, Bangladesh, 1987–93**

	Antenatal markers[a]	Gestational age <37 weeks	Labour complications[b]
Prevalence (%)	42.4	20.0	12.0
No. of perinatal deaths per 1000 births	99.8	148.2	219.8
Adjusted odds ratio[c]	1.99 (1.54–2.58)[d,e]	3.36 (2.57–4.38)[e]	5.36 (4.06–7.07)[e]
Population-attributable risk percent	26.3	27.3	30.2

[a] Antenatal markers include: maternal age ⩽ 18 years, bad obstetric history, maternal upper-arm circumference ⩾ 250mm, maternal weight =10th percentile for gestational age, pre-eclampsia and jaundice.

[b] Labour complications include: breech or other malpresentation, prolonged or obstructed labour and eclampsia.

[c] Adjusted for demographic and nutritional markers, signs and symptoms in pregnancy, length of gestation and complications during labour.

[d] Figures in parentheses are 95% confidence intervals.

[e] $P<0.01$.

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Résumé

La part des complications de l'accouchement dans la mortalité périnatale : Matlab (Bangladesh)

On sait depuis longtemps que les complications au cours de l'accouchement augmentent le risque de décès périnatal, mais très peu d'études sur la mortalité périnatale dans les pays en développement ont permis d'évaluer en population la proportion des décès périnatals imputable à des facteurs de risque du per-partum. Etant donné l'accent actuellement mis sur l'amélioration des soins pendant le travail et l'accouchement afin de réduire la mortalité maternelle, il semble important d'évaluer dans quelle mesure une telle approche pourrait également contribuer à réduire la mortalité périnatale. L'objectif de cette étude était de déterminer quelle est la proportion de décès périnatals qui sont attribuables à des complications survenues pendant l'accouchement à Matlab, au Bangladesh.

On s'est servi de données communautaires tirées d'un programme de soins à domicile conduit par des sages-femmes professionnelles entre 1987 et 1993. Pour chaque femme enceinte, la sage-femme remplissait une carte indiquant les soins prodigués pendant la période prénatale, au cours de l'accouchement et dans le post-partum ; on disposait de données supplémentaires sur les femmes admises au centre de soins de Matlab dans le registre du service de maternité. Au cours des visites prénatales, les sages-femmes notaient les données socio-démographiques, anthropométriques et médicales. Toute pathologie maternelle pendant la grossesse, le travail ou l'accouchement était enregistrée et prise en charge. Les facteurs de risque de la mortalité périnatale étaient évalués au moyen d'une analyse de régression logistique incorporant les facteurs prénatals (marqueurs démographiques et nutritionnels, signes et symptômes pendant la grossesse), l'âge gestationnel et les complications survenues pendant le travail. On a calculé la fraction étiologique du risque pour les variables incluses dans le modèle final à partir des odds ratios corrigés et de la prévalence du facteur de risque dans la population exposée.

Sur les 3854 femmes qui avaient bénéficié de soins prénatals et lors de l'accouchement et dont le terme dépassait 27 semaines, le taux de mortalité périnatale était de 71,4 pour 1000 naissances. Après contrôle de tous les facteurs étudiés, les marqueurs démographiques et nutritionnels associés de façon significative à la mortalité périnatale étaient le jeune âge de la mère ($\leqslant$ 18 ans), des antécédents obstétricaux difficiles, un périmètre brachial $\geqslant$ 250 mm et la minceur de la mère (poids $\leqslant$ 10^{e} percentile pour l'âge gestationnel). Les signes et symptômes prénatals associés de façon significative au décès périnatal étaient la prééclampsie et l'ictère. Le déclenchement prématuré du travail multipliait par quatre le risque de décès périnatal (odds ratio (OR) = 3,82). Les complications associées à une forte mortalité périnatale étaient les suivantes : présentation du siège (OR = 8,3), autres positions anormales du fœtus (OR = 16,5), travail prolongé (OR = 2,5) et dystocique (OR = 26,4), et éclampsie (OR = 7,9). Les complications survenues pendant le travail et l'accouchement – tels un travail prolongé ou dystocique, une position fœtale anormale et une hypertension gravidique – ont été à l'origine de 30 % des décès périnatals. Le déclenchement prématuré du travail, présent dans 20 % des grossesses, a été à l'origine de 27 % de la mortalité périnatale.

Dans cette population, les efforts visant à mieux former les sages-femmes à la prise en charge du travail et aux soins aux nouveau-nés, s'ils sont appuyés par des mécanismes efficaces d'orientation-recours, permettront de réduire sensiblement la mortalité périnatale.

Resumen

Mortalidad perinatal atribuible a complicaciones del parto en Matlab, Bangladesh

Se sabe desde hace tiempo que las complicaciones surgidas durante el parto aumentan el riesgo de defunción perinatal, pero son muy pocos los estudios poblacionales de la mortalidad perinatal realizados en países en desarrollo para evaluar la proporción de defunciones perinatales atribuible a factores de riesgo intraparto. Teniendo en cuenta el actual interés por mejorar la atención durante el parto para reducir la mortalidad materna, parece importante evaluar en qué medida ese empeño puede contribuir igualmente a reducir la mortalidad perinatal. El objetivo de este estudio consistió en evaluar la proporción de defunciones perinatales atribuibles a complicaciones surgidas durante el parto en Matlab (Bangladesh).

Se utilizaron los datos comunitarios de un programa de base domiciliaria llevado a cabo por parteras profesionales entre 1987 y 1993. Cada mujer embarazada era seguida por una partera mediante una ficha que abarcaba el periodo prenatal, el parto y el posparto; en el registro de la maternidad se obtuvieron datos adicionales sobre las mujeres ingresadas en el dispensario de Matlab. Durante las visitas prenatales las parteras anotaban los factores sociodemográficos, antropométricos y médicos pertinentes. Toda enfermedad materna surgida durante el embarazo o el parto era registrada y tratada. Se evaluaron los factores de riesgo de la mortalidad perinatal empleando un método de regresión logística que incorporaba factores prenatales (marcadores demográficos y nutricionales, signos y síntomas aparecidos durante el embarazo), la duración de la gestación y las complicaciones surgidas durante el parto. Se calculó la fracción atribuible poblacional para las variables incluidas en el modelo final, a partir de las razones de posibilidades (OR) ajustadas y de la prevalencia del factor de riesgo entre las mujeres expuestas.

Entre las 3854 mujeres que habían recibido atención prenatal y durante el parto y que estaban embarazadas de más de 27 semanas, la tasa de mortalidad perinatal fue de 71,4 por mil nacimientos. Tras controlar todos los factores estudiados, los marcadores demográficos y nutricionales significativamente relacionados con la mortalidad perinatal fueron una baja edad de la madre ($\leqslant$ 18 años), unos antecedentes de mala atención obstétrica, una circunferencia de la parte superior del brazo $\geqslant$ 250 mm, y un bajo peso corporal ($\leqslant$ 10^{o} percentil para la edad gestacional). Los signos y síntomas prenatales significativamente asociados a los casos de defunción perinatal fueron la preeclampsia y la ictericia. El parto prematuro multiplicaba por cuatro el riesgo de defunción perinatal (OR = 3,82). Las complicaciones del parto asociadas a una alta mortalidad perinatal fueron la presentación de nalgas (OR = 8,3), otras posiciones fetales anormales (OR = 16,5), el parto prolongado (OR = 2,5) y el parto obstruido (OR = 26,4), y la eclampsia (OR = 7,9). Las complicaciones surgidas durante el trabajo de parto y el parto – como por ejemplo el parto prolongado u obstruido, una posición fetal anormal y las enfermedades hipertensivas del embarazo – causaron el 30% de las defunciones perinatales. El parto prematuro, que afecta al 20% de los embarazos, causó el 27% de la mortalidad perinatal.

En la población estudiada, las actividades encaminadas a mejorar la formación de las parteras en el manejo del parto y la asistencia al recién nacido, con el respaldo de unos mecanismos de derivación eficaces, contribuirán a reducir sustancialmente la mortalidad perinatal.

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