Labour complications remain the most important risk factors for perinatal mortality in rural Kenya

Renay Weiner,[1] Carine Ronsmans,[2] Ed Dorman,[3] Hilton Jilo,[4] Anne Muhoro,[5] & Caroline Shulman[6]

Objectives To identify and quantify risk factors for perinatal mortality in a Kenyan district hospital and to assess the proportion of perinatal deaths attributable to labour complications, maternal undernutrition, malaria, anaemia and human immunodeficiency virus (HIV).

Methods A cross-sectional study of 910 births was conducted between January 1996 and July 1997 and risk factors for perinatal mortality were analysed.

Findings The perinatal mortality rate was 118 per 1000 births. Complications of labour such as haemorrhage, premature rupture of membranes/premature labour, and obstructed labour/ malpresentation increased the risk of death between 8- and 62-fold, and 53% of all perinatal deaths were attributable to labour complications. Placental malaria and maternal HIV, on the other hand, were not associated with perinatal mortality.

Conclusions Greater attention needs to be given to the quality of obstetric care provided in the rural district-hospital setting.

Keywords Infant mortality; Labor complications/mortality; Maternal nutrition; Prenatal care; HIV infections; Risk factors; Rural population; Cross-sectional studies; Kenya (*source: MeSH, NLM*)

Mots clés Mortalité nourrisson; Accouchement compliqué/mortalité; Nutrition maternelle; Soins prénataux; HIV, Infection; Facteur risque; Population rurale; Etude section efficace; Kenya (*source: MeSH, INSERM*).

Palabras clave Mortalidad infantil; Complicaciones del trabajo de parto/mortalidad; Nutrición materna; Atención prenatal; Infecciones por VIH; Factores de riesgo; Población rural; Estudios transversales; Kenya (*fuente: DeCS, BIREME*).

الكلمات المفتاحية : وفيات الرضع؛ مضاعفات الولادة، الوفيات الناجمة عن مضاعفات الولادة؛ تغذية الأمهات؛ الرعاية في الفترة المحيطة بالولادة؛ العدوى بفيروس الإيدز؛ عوامل الخطر؛ السكان الريفيون؛ دراسات مستعرضة؛ كينيا (المصدر: رؤوس الموضوعات الطبية ، المكتب الإقليمي لشرق المتوسط).

Introduction

Perinatal mortality is an important indicator of obstetric care, health status and socio-economic development (*1*). Perinatal mortality rates are highest in developing countries, particularly in Africa. In 1995, WHO estimated a perinatal mortality rate of 75 per 1000 births in Africa, a modest decline from the rate of 81 per 1000 births in 1983 and substantially higher than in more-developed countries, where the estimated rate was 11 per 1000 births (*1*).

The approach to improving maternal and perinatal health in developing countries has shifted in the last decade. In the1980s, WHO promoted the risk approach which involved screening and risk classification of pregnancies based on maternal characteristics (*3*). Evidence emerged, however, that complications around the time of labour or delivery and perinatal deaths are not easily predictable, and that antenatal risk screening might be limited in its capacity to reduce maternal and perinatal mortality (*4, 5*). Consequently, safe motherhood programmes have focused on improving care during labour including strengthening emergency obstetric services (*6*). Having a health worker with midwifery skills present at delivery is now seen as one of the most critical interventions for making motherhood safer (*6*).

The extent to which the skilled-attendant approach will also reduce perinatal mortality is less certain. Few studies have simultaneously considered the importance of intra-partum morbidity, sociodemographic factors, and prevalent maternal illnesses such as infection with human immunodeficiency virus (HIV), malaria, and poor nutrition as risk factors for perinatal mortality. The proportion of perinatal deaths attributable to such factors also is not well known. The aim of the current study is to identify and quantify risk factors for perinatal mortality in a rural African hospital and to assess the role of labour complications in addition to sociodemographic factors and maternal illnesses such as malaria, HIV infection, anaemia and undernutrition.

[1] Lecturer and Specialist in Public Health Medicine, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, 7 York Road, Parktown, 2193, Johannesburg, South Africa (email: weinerr@sph.wits.ac.za). Correspondence should be addressed to this author.

[2] Senior Lecturer, Infectious Disease Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, England.

[3] Consultant Obstetrician, Homerton Hospital, London, England; and Kenya Medical Research Institute, Centre for Geographical Medicine Research, Kilifi, Kenya.

[4] Obstetrician and Gynaecologist, Kilifi District Hospital, Kilifi, Kenya.

[5] Midwife, Kenya Medical Research Institute, Centre for Geographical Medicine Research, Kilifi, Kenya.

[6] Senior Lecturer, Department of Infectious and Tropical Diseases, LSHTM, Keppel Street, London; and Kenya Medical Research Institute, Centre for Geographical Medicine Research, Kilifi, Kenya.

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Materials and methods

Study sample and population

The study population consisted of women who delivered at Kilifi district hospital, Kenya between January 1996 and July 1997. Kilifi, situated 60 km north of Mombasa on the Kenyan coast, is a predominantly rural, farming district with a population of approximately 700 000 (7). The majority of women attend antenatal care, either at a dispensary, health centre or hospital. Less than half of all women from this district deliver in hospital, so the women are not likely to be representative of the entire study population. Rather, they are a self-selecting group, and in this study area appear to consist of a higher proportion of the more-educated urban women and also a higher proportion of those experiencing complicated deliveries (C. Shulman, personal communication). The study sample comprised approximately 50% of deliveries at the hospital during the study period (8). Since this study was part of a larger one investigating the association between malaria, anaemia, birthweight, pre-eclampsia and intra-uterine fetal deaths, women with any of these complications were more likely to be included (8). Women with multiple pregnancies, significant antenatal haemorrhage prior to admission, and those participating in an antimalarial intervention trial for primigravidae, on the other hand, were excluded.

Data collection

A combination of data collection methods was used: blood samples were collected on admission for the measurement of blood haemoglobin levels using a Coulter Counter and HIV antibodies using an immunoglobulin G antibody capture particle-adherence test (GACPAT) (9). Placental samples were taken at delivery for histological assessment of malaria. The presence of malaria parasites in erythrocytes in the intervillous space was taken to indicate the presence of active infection and the presence of malaria pigment in fibrin, chronic or past infection (10). A structured questionnaire was administered to each woman after delivery to collect information on socio-demographic markers, antenatal attendance, mode of delivery, birth outcome and condition of her baby at the time of discharge. Maternal weight and height were measured after delivery, just prior to discharge from hospital, and expressed as body mass index (BMI – weight (kg)/ height (m) ^{2}). Medical records of discharge diagnoses were reviewed for data on labour complications and we relied on case definitions as noted in the records. Only complications during labour were included. Women with serious antepartum haemorrhage prior to the onset of labour were excluded. Antepartum haemorrhage was defined as a woman who had a discharge diagnosis of antepartum haemorrhage and/or abruptio placentae, but excluded women with placenta previa. Obstructed labour was defined when the medical record documented a diagnosis of either obstructed labour or prolonged labour. Informed consent was obtained from all women prior to participation in the study.

Data analysis

Data were analysed using Stata 7 software. Perinatal death was defined as stillbirths and deaths occurring in the first week of life. Categorical variables were grouped according to risk categories and continuous variables were converted to categorical variables, using WHO criteria for anaemia and quartiles for BMI. Malaria in pregnancy was defined as the presence of histological evidence of active, chronic or past placental malaria infection (10). Associations with perinatal mortality were expressed as odds ratios (OR) with their 95% confidence intervals (CI). Multivariate logistic regression was conducted to assess the strength of the association between antenatal and intra-partum risk factors for perinatal death, while adjusting for all other factors. The independence of each variable and interactions between malaria and anaemia, and malaria and gravidity were assessed using the likelihood ratio test. The population-attributable fraction (PAF) was calculated for the variables included in the final model, based on the adjusted ORs and the prevalence of the risk factor among the exposed (11).

Results

The sample size consisted of 910 births. The mean age of the women was 23.9 years (range 14–43 years), approximately 30% were primigravidae, 25% had not received any formal education, and all women for whom there were data attended antenatal clinics at least once (Table 1). Severe anaemia (Hb < 7 g/dl) was present in 14% of the women, 9% were HIV-positive, and 47% had placental malaria. Labour complications were noted for 20% of women, while seven suffered from more than one complication. Obstructed or prolonged labour was the most commonly noted labour complication (8.5%).

There were 108 perinatal deaths giving an overall perinatal mortality rate (PNMR) of 118 per 1000 births. The PNMR was significantly higher among women without any schooling, those with a history of previous stillbirths, and those who had attended fewer than three antenatal visits (Table 1). Perinatal mortality was associated with severe anaemia (OR = 2.2; CI 1.1–4.3) and low BMI (OR = 3.1; CI 1.7–5.6), but not with HIV infection status (OR = 0.96; CI 0.46–1.99) or placental malaria (OR = 0.68, 95% CI 0.44–1.04). The PNMR for women who had no reported labour complications was 59 per 1000 births compared to 367 per 1000 for women with abnormal labour (OR = 9.31; CI 5.83–14.88). Haemorrhage was associated with the highest perinatal mortality rate (750 per 1000 births), followed by malpresentation (714 per 1000 births), and eclampsia (615 per 1000 births). The perinatal mortality rate associated with induced births was extremely high (618 per 1000 births) because stillbirths were an indication for induction of labour rather than vice versa.

The results of multivariate analysis are presented in Table 2. Age, ownership of a latrine and sex of the baby were excluded from the model because they were neither confounders nor independent risk factors for perinatal mortality. Mode of delivery was also excluded because it was on the causal pathway between labour complications and perinatal mortality.

After adjustment for other risk factors and potential confounders, labour complications were the main risk factors for perinatal mortality. Women with an antepartum bleed were over 60 times more likely to have a perinatal death than women without any bleeding (adjusted OR = 61.9; CI 13.9–274.2), and the risk of perinatal mortality was eight and 13 times higher, respectively, for women with obstructed or prolonged labour / malpresentation (OR = 7.9; CI 3.92–15.94) and premature rupture of membranes/premature labour (OR = 13.6; CI 5.2–35.7). After adjustment, the risk associated with other complications increased substantially (OR = 52; CI 11.2–

Table 1. Prevalence, perinatal mortality and crude odds ratios for selected risk markers of perinatal death among 910 births in Kilifi district hospital, 1996–97

Risk markers	Prevalence (%)	Perinatal death per 1000 births (number of deaths)	Crude odds ratio (95% CI)
Socio-demographic markers			
Maternal age (years)	19.4	124.3 (22)	1.19 (0.70–2.00)
< 20	3.5	93.8 (3)	0.86 (0.26–2.93)
> 35	15.3	165.5 (23)	1.66 (0.98–2.79)
Unknown			
Gravidity			
1	29.5	97.0 (26)	0.83 (0.51–1.35)
> 6	15.9	172.4 (25)	1.61 (0.96–2.68)
Previous stillbirths	12.0	275.2 (30)	3.52 (2.18–5.69)
Boy	51.9	122.9 (58)	1.11 (0.74–1.66)
No schooling	25.2	174.7 (40)	1.90 (1.24–2.91)
No latrine in household	29.3	150.4 (40)	1.49 (0.98–2.27)
Antenatal care			
Number of visits			
⩽ 2	14.2	232.6 (30)	3.00 (1.84–4.86)
Unknown	11.7	150.9 (16)	1.76 (0.97–3.18)
Nutritional markers			
Maternal haemoglobin (g/dl)			
< 7	13.8	192.0 (24)	2.20 (1.14–4.26)
7–10.9	65.8	110.7 (66)	1.15 (0.67–2.00)
Body mass index (kg/m^2)			
< 25th percentile	25.0	192.0 (43)	3.07 (1.67–5.64)
26th–50th percentile	25.0	102.7 (23)	1.48 (0.76–2.88)
> 75th percentile	25.1	88.9 (20)	1.26 (0.64–2.50)
Maternal infection			
HIV positive	8.6	115.4 (9)	0.96 (0.47–1.99)
Placental malaria	47.1	96.5 (41)	0.68 (0.45–1.04)
Mode of delivery			
Assisted	3.4	225.8 (7)	2.25 (0.94–5.35)
Caesarean section	3.7	352.9 (12)	4.43 (2.13–9.24)
Labour complications			
Obstructed/prolonged labour	8.5	246.8 (19)	2.74 (1.55–4.83)
Malpresentation	1.5	714.3 (10)	20.36 (6.06–68.32)
Pre-eclampsia	5.0	288.9 (13)	3.29 (1.66–6.53)
Eclampsia	1.4	615.4 (8)	13.00 (4.08–41.37)
Antepartum haemorrhage	1.3	750.0 (9)	24.29 (6.22–94.24)
Premature rupture of membranes/premature labour	2.9	500.0 (13)	8.31 (3.68–18.76)
Induction	6.0	618.2 (34)	17.08 (8.96–32.60)
Other complications[a]/missing	1.2	545.5 (6)	9.37 (2.77–31.70)
Any complication, excluding induction	19.5	367.2 (65)	9.31 (5.83–14.88)

[a] Other complications include foetal abnormality, maternal diabetes, birth before arrival and previous caesarean section.

236.7). When the data were reanalysed excluding labour complications of unknown cause (missing data), a lower risk was measured for the category other (OR = 21.6; CI 2.7–167).

Antenatal risk factors that remained significant after adjustment were poor nutrition (OR = 3.6; CI 1.6–8.1) and previous stillbirths (OR = 2.5; CI 1.3–5.1). No evidence for significant interactions was found between malaria and HIV infection status (P = 0.49), malaria and anaemia (P = 0.55), malaria and gravidity (P = 0.93), and anaemia and HIV infection status (P = 0.52). The PAF was 53% for labour complications, followed by 25% and 17% for poor nutrition and prior stillbirths, respectively.

Discussion

This hospital-based study in rural Kenya has shown that labour complications have a very strong effect on perinatal mortality.

Complications such as antepartum haemorrhage, obstruction or prolonged/malpresentation, eclampsia, prematurity and premature rupture of membranes increased the risk of perinatal death between 8- and 62-fold, and 53% of all perinatal deaths were attributable to labour complications. Placental malaria and maternal HIV infection status, on the other hand, were not associated with perinatal mortality in this study.

The sample was hospital based and the sampling procedure was not random, hence caution is required in the interpretation of results, particularly attributable fractions. The PNMR, for example, might have been over-estimated, since low-birth-weight babies and intrauterine deaths were over-sampled. Conversely, babies who were discharged and died at home within the first week of life may have resulted in not all deaths from the sample being included. Some obstetric

Table 2. Adjusted odds ratios and population attributable risk for selected risk markers of perinatal death, Kilifi district hospital, 1996–97

Risk marker	Adjusted odds ratio (95% CI)	Population attributable fraction (%)
Socio-demographic markers		
Gravidity		
1	0.89 (0.45–1.79)	–
2–5	1.00	
> 6	0.90 (0.41–1.96)	–
Previous stillbirths	2.52 (1.25–5.05)	16.8
No schooling	1.73 (0.92–3.24)	–
Antenatal care		
Number of visits		
⩽ 2	1.91 (0.99–3.99)	13.3
> 2 visits	1.00	
Unknown	1.84 (0.82–4.15)	–
Nutritional markers		
Maternal haemoglobin (g/dl)		
< 7	1.08 (0.44–2.65)	–
7–10.9	0.71 (0.35–1.45)	
⩾ 11	1.00	
Body mass index (kg/m^2)		
< 25th percentile	3.62 (1.62–8.11)	24.6[a]
26th–50th percentile	2.32 (0.97–5.52)	
51st–75th percentile	1.00	
> 75th percentile	0.99 (0.40–2.46)	
Maternal infection		
HIV-positive	1.01 (0.38–2.70)	–
Placental malaria	0.87 (0.49–1.54)	–
Labour complications		
Obstructed/prolonged labour or malpresentation	7.91 (3.92–15.94)	19.4
Pre-eclampsia or eclampsia	1.92 (0.75–4.91)	9.3
Antepartum haemorrhage	61.89 (13.97–274.18)	8.1
Premature rupture of membranes/ premature labour	13.63 (5.20–35.73)	11.3
Induction of labour	33.13 (14.14–77.60)	30.5
Other complications	51.55 (11.22–236.70)	5.4
Any complication (excluding induction)	9.01 (5.30–15.29)	52.8

[a] Compared to all other women (OR = 2.6; CI 1.46–4.64).

complications may have been overrepresented, and providers may have been more likely to record a problem when the baby was stillborn, thus inflating the PAF for labour complications. However, the large odds ratios for the association between labour complications and perinatal mortality cannot be explained on the basis of bias alone. Despite some methodological weaknesses, there is no doubt that labour complications are important causes of perinatal death in this hospital.

Prolonged labour

Our findings are consistent with those from other studies in Kenya and elsewhere. Kavoo-Linge & Rogo (12) identified prolonged labour as a particularly important factor for perinatal deaths occurring within the first 24 h after hospital delivery in Kenya, while labour complications were associated with perinatal death in almost 40% of deliveries in another rural district. (12, 13). Data from West Africa, Bangladesh, and Guatemala also confirm high perinatal mortality following prolonged labour or malpresentation (14–17). Premature labour is a known risk factor for perinatal death (18) and the importance of haemorrhage during labour as a risk factor for perinatal mortality has previously been documented in West Africa and India (14, 19, 20). Although effective interventions may not fully eliminate the risk of death, emergency management of abruptio placentae, early detection and management of malpresentation, and better monitoring of labour could result in significant reductions in perinatal mortality.

Maternal nutrition

Poor maternal nutrition has been associated with increased perinatal mortality in other developing countries (16, 19, 21). Moreover, weight gain during pregnancy appears to be important and decreases in perinatal deaths associated with increasing maternal weight have been demonstrated suggesting that nutritional interventions during pregnancy are important (21–23).

Antenatal visits

Although not statistically significant after adjustment, the risks associated with few antenatal visits need to be interpreted with caution. The large proportion of missing data and recall bias may have further influenced the validity of the results. The content, number and timing of antenatal visits in developing countries has recently received rigorous evaluation. A multi-centred randomized controlled trial comparing the existing versus a revised model of fewer, goal-oriented activities has shown similar outcomes in the two groups (24, 25). This is supported by evidence from Zimbabwe, which has shown that fewer antenatal visits, four versus seven, does not lead to adverse effects on pregnancy (26).

Maternal anaemia

The lack of a statistically significant association with severe maternal anaemia after adjustment for confounders and the apparently protective effect of malaria on perinatal mortality highlight the complexity of the interrelation between maternal anaemia, placental malaria and gravidity (8). The study may have lacked power to detect interactions between these factors, in particular between primigravidity, anaemia and malaria. Some authors have found an association between maternal anaemia and perinatal mortality (19, 25) while others have not (16). A systematic review of randomized controlled trials has revealed that the existing data on the effects of iron and folate supplementation on perinatal outcomes are very limited and clear benefits have not been demonstrated (27). However, this is unsurprising as most of these trials were conducted in industrialized countries and excluded women with anything other than mild anaemia. Malaria in pregnancy is generally accepted to increase the risk of low birth weight and maternal anaemia (28, 29). In highly endemic areas, however, no clear contribution of placental malaria to perinatal death has been observed (30) and in rural Malawi, placental malaria diagnosed on blood smear appeared to be associated with lower perinatal mortality among normal birthweight babies (31). Further research on the interaction between malaria and anaemia and their impact on perinatal outcomes is required.

Maternal HIV infection status

In this study, maternal HIV infection status was not a risk factor for perinatal deaths, a finding consistent with data from a larger

sample in rural Malawi (*32*). In a meta-analysis of the association between maternal HIV infection and perinatal outcomes a summary odds ratio of 1.79 (CI 1.14–2.81) was measured for the effect of HIV infection status on perinatal mortality, but publication bias and uncontrolled confounding, particularly in studies from developing countries, may account for part of these findings. In Kenya, an association between HIV infection status and intrauterine and intrapartum deaths was found after confounders were controlled (*34*). The lack of consistency in the associations between HIV infection status and stillbirth rates may reflect the extent of the epidemic and the nature of the HIV-related disease in different communities (*35*).

Consistent with the limited data available in Africa, the findings of this study indicate that in a hospital setting, labour complications pose the greatest risk for perinatal mortality. Even where labour care is provided, high risks are associated with complications such as obstructed labour and haemorrhage. This presents an opportunity for effective health service intervention. If detected early and appropriately managed, many problems that arise in labour can be limited, and serious morbidity and mortality can be averted. The findings add support to strategies that focus on improving the quality of labour care, and mutual gains in perinatal and maternal health can be expected. However, the role of early detection and management of antenatal risk factors such as hypertension and poor maternal nutrition continues to be important. ■

Résumé

Les complications du travail restent les facteurs de risque les plus importants de mortalité périnatale dans les zones rurales du Kenya

Objectif Identifier et dénombrer les facteurs de risque de mortalité périnatale dans un hôpital de district au Kenya et évaluer la proportion de décès périnatals due aux complications du travail, à la dénutrition maternelle, au paludisme, à l'anémie et au virus de l'immunodéficience humaine (VIH).

Méthodes Une étude transversale sur 910 naissances a été réalisée entre janvier 1996 et juillet 1997, et les facteurs de risque de mortalité périnatale analysés.

Résultats Le taux de mortalité périnatale était de 118 pour 1000 naissances vivantes. Les complications du travail telles que hémorragie, rupture prématurée des membranes/accouchement prématuré, dystocie/présentation vicieuse, multipliaient le risque de décès de 8 à 62 fois, et 53 % de l'ensemble des décès maternels étaient imputables aux complications du travail. Par ailleurs le paludisme placentaire et le VIH de la mère n'étaient pas associés à la mortalité maternelle.

Conclusion Il convient d'accorder une attention plus grande à la qualité des soins obstétricaux dispensés dans un hôpital de district rural.

Resumen

Las complicaciones del parto siguen siendo el factor de riesgo de mortalidad perinatal más importante en la Kenya rural

Objetivo Identificar y cuantificar los factores de riesgo de mortalidad perinatal en un hospital de distrito de Kenya y evaluar la proporción de defunciones perinatales atribuibles a complicaciones del parto, desnutrición materna, malaria, anemia y virus de la inmunodeficiencia humana (VIH).

Métodos Entre enero de 1996 y julio de 1997 se realizó un estudio transversal de 910 nacimientos para analizar los factores de riesgo de defunción perinatal.

Resultados La tasa de mortalidad perinatal fue de 118 por 1000 nacimientos. Las complicaciones del parto consistentes en hemorragias, ruptura prematura de membranas/parto prematuro, y parto obstruido/presentación defectuosa multiplicaban el riesgo de defunción por un factor de entre 8 y 62, y el 53% de todas las defunciones perinatales se atribuyeron a complicaciones del parto. La malaria placentaria y el VIH materno, en cambio, no se asociaron a mortalidad perinatal.

Conclusión Es necesario prestar más atención a la calidad de la atención obstétrica dispensada en el entorno de los hospitales de distrito rurales.

ملخص

ما تزال مضاعفات الولادة أهم عوامل الخطر المسبِّبة للوفيات في الفترة المحيطة بالولادة في أرياف كينيا

الهدف: استعراف وتقدير حجم عوامل الخطر المسبة للوفيات في الفترة المحيطة بالولادة، والتي تُعزى إلى مضاعفات الولادة، وسوء تغذية الأم، والملاريا، وفقر الدم، وفيروس العوز المناعي البشري.

الطرق: أجريت دراسة مستعرضة شملت ٩١٠ ولادات في الفترة من كانون الثاني/يناير ١٩٩٦ إلى تموز/يوليو ١٩٩٧، وتم تحليل عوامل الخطر المسببة للوفيات في الفترة المحيطة بالولادة.

الموجودات: بلغت نسبة الوفيات في الفترة المحيطة بالولادة ١١٨ لكل ١٠٠٠ ولادة. وتبين أن مضاعفات الولادة، مثل النزف والتمزق

المبكر للأغشية والولادة المبتسرة (الخداج)، والولادة المعرقلة وسوء المجيء، قد أدت إلى زيادة مخاطر الوفاة بمقدار يتراوح بين ٨ أضعاف و٦٢ ضعفاً، وأن ٥٣٪ من جميع الوفيات في الفترة المحيطة بالولادة تُعزى إلى مضاعفات الولادة. ومن ناحية أخرى، لم يثبت ارتباط فقر الدم المشيمي وعدوى الأم بفيروس الإيدز بوفيات الفترة المحيطة بالولادة.

الخلاصة: ينبغي إيلاء مزيد من الاهتمام بجودة الرعاية التوليدية المقدمة في مستشفيات المناطق الصحية الريفية.

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