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The Contribution of Severe Pre-Eclampsia and Eclampsia to Perinatal Mortality in a Nigerian Teaching Hospital

Olufemiwa Niyi Makinde
Dept. of Obstetrics, Gynaecology and Perinatology, College of Health Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria

1. Introduction

The continuum of pre-eclampsia/eclampsia accounts for about one-third of maternal deaths in developing countries (Thomas, 1998).Perinatal deaths still occur preponderantly in low-income and middle-income countries and in places such as south Asia and sub-Saharan Africa, many of these occur during labor or birth. These are areas where, if the median proportion of births attended by skilled attendants were 100% rather than 49%, or if the median caesarean section was 24% instead of 3%, most of these tragedies would not have happened (Lawn, 2011).In each materno-fetal unit, the mother is like an "incubator" for the fetus. Perinatal outcome directly reflects the quality of existing obstetrical and neonatal services (Baveja, 2001, Lumley & Bakoula, 1993). Consequently, adverse outcomes to the mother during pregnancy and labour may impact negatively on the fetus and newborn resulting in perinatal death. A composite perinatal audit is the need of the hour for each obstetric unit so as to evolve a system of professional analysis of maternal and child health (MCH) services This study aims to: (i) highlight the magnitude of perinatal mortality among 39 consecutive cases of **severe pre-eclampsia/eclampsia(SPEE)**during the study period; (ii) classify perinatal deaths using the Tulip classification; (iii) to determine the effect of birthweight, antenatal care, multiple pregnancy and parity on perinatal death; (iv)to highlight the imperativeness of skilled attendance at birth on a 24 hour basis by using the workload indicator of staffing needs(WISN) concept; (v) to profer suggestions to accelerate progress for coverage of clinical-care interventions to stem the tide of intolerably high perinatal mortality rate among cases of **SPEE**.

2. Patients and methods

During the study period from 1st of January,2006 to 31st of January,2007, 39 consecutive cases of SPEE were admitted into the maternity unit of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife Nigeria. Each case on presentation was categorized into (1) severe pre-eclampsia, on the basis of hypertension after the 20th week of gestation, the diastolic blood pressure $\geq$110 mmHg on admission, proteinuria $\geq$30mg/dl in random urine specimen or $\geq$ 300mg in a 24hr urine specimen. (2) Imminent eclampsia, on account of

parameters in (1) and symptoms of headache, blurring of vision and upper abdominal pain. (3) Eclampsia, existence of the parameters in (1) and occurrence of seizures.

The infant outcome of all the consecutive cases of **SPEE** admitted during the study period were determined. The perinatal mortality (**PNM**) rate associated with cases of SPEE was determined. Perinatal deaths were classified using the Tulip classification (6 main causes and 6 mechanisms). The 6 main causes of perinatal mortality were congenital anomaly, placental/umbilical disorders, prematurity, infection, others like fetal hydrops of unknown origin, maternal disease, trauma and unknown causes. Five expert observers (raters) namely 3 senior registrars in obstetrics,1 senior registrar in neonatology and 1 pathologist independently determined the most probable cause of perinatal death and the mechanism of such death for each case. Statistical analysis was by Stata version 11. Fleiss kappa was used to determine the degree of agreement beyond chance. Kappa value ranging from 0.81 – 1.00 indicates very good strength of agreement and value ranging from 0.21- 0.40 indicates fair agreement The 6 specified mechanisms for PNM are cardio-circulatory insufficiency, multi-organ failure, respiratory insufficiency, cerebral insufficiency, placental insufficiency and unknown causes. The effect of antenatal care, birth weight, multiple pregnancy and parity on perinatal mortality among the cohort of cases of SPEE was also determined.

The workload indicator for staffing need (WISN) ratio was also determined for the labour ward, labour ward theatre and neonatal intensive care unit. This is a WHO concept developed to show the adequacy or otherwise of available skilled attendants manning hospital units such as the labour/labour ward theatre delivery and neonatal care units. The patient load of the unit is determined and the job description for each cadre of skilled attendants is determined. From these, the required number of staff needed is calculated making provisions for sick leave, annual leave and off duty. The WISN ratio is calculated thus: ACTUAL number of staff on ground (numerator)/ REQUIRED (Calculated) number of staff(denominator). If the WISN ratio is < 1.0, the staff strength is inadequate. If the ratio is ≥ 1.0, the staff strength is adequate or more than enough.

3. Results

During the study period, there were 39 consecutive cases of SPEE with 43 infants delivered. The age of the mothers ranged from 18-38 years, 27(69.2%) were unbooked and the gestational age at presentation ranged from 22-41 weeks. The cases were severe pre-eclampsia 16 (41.02%), imminent eclampsia11(28.2%), eclampsia- antepartum 6(15.4%), intrapartum 2(5.1%), and postpartum 4(10.3%).10 (25.6%) of the mothers with SPEE had spontaneous vaginal delivery, 4(10.3%) had operative vaginal delivery while majority 25(64.1%) had lower segment Caesarean section.

Perinatal mortality among the women with severe preecalmapsia/eclampsia is shown in Table 1. There was 6 perinatal deaths among the four cases. Three early neonatal death were in a set of triplet. All the mothers with perinatal deaths were unbooked despite the fact that they were all high risk cases namely multiple pregnancy of higher fetal order, primigravidity, grand-multiparity and previous perinatal death. All the cases with perinatal death were also delivered preterm.

During the study period, there were 6 (13.95%) perinatal deaths out of 43 infants delivered by mothers with SPEE. The total births during the period were 1026. Consequently, the

perinatal mortality rate associated with cases of SPEE (a single disease entity) during the study period was 5.84 per 1000 births.

S/N	AGE (Years)	Parity	E.G.A (Weeks)	Booking status	Diagnosis at presentation	Mode of Delivery	Infant outcome
1	31	P2	31	U	Eclampsia (Postpartum)	Spontaneous Vaginal Delivery	Triplets, Early neonatal death. All dead before arrival
2	21	P0	22	U	Eclampsia (Antepartum)	Spontaneous Vaginal Delivery	0.7kg; Male; Early neonatal death.
3	35	P5	31	U	Imminent Eclampsia	Spontaneous Vaginal Delivery	2.3kg; Male; Fresh Still Birth
4	30	P3	36	U	Imminent Eclampsia	Spontaneous Vaginal Delivery	2.8kg; Male; Fresh Still Birth

Table 1. Perinatal mortality among the women with severe preeclampsia/ eclampsia during the study period.

The causes of perinatal deaths among the cohort are in shown in Table 2a. It shows the level of agreement between the 5 expert raters concerning the cause of each perinatal death. While there was consensus that prematurity was the cause of perinatal death in the first 4 cases, the cause of perinatal death in cases 5 and 6 was agreed to be due to placenta and cord anomaly (Kappa = 1.00, z=7.75, p<0001). Showing a very good strength of agreement among the 5 expert observers as regards the most probable cause of death for each case.

Cases of Perinatal Mortality	Congenital Anomaly	Placenta and Cord Anomaly	Prematurity	Infection	Others	Unknown
Case 1	0	0	5	0	0	0
Case 2	0	0	5	0	0	0
Case 3	0	0	5	0	0	0
Case 4	0	0	5	0	0	0
Case 5	0	5	0	0	0	0
Case 6	0	5	0	0	0	0

Kappa = 1.00, z=7.75, p<0001

Table 2a.The causes of perinatal deaths among cases of SPEE by the experts according to Tulip classification.

Table 2b shows the mechanism for perinatal deaths according to the 5 expert raters.

Cases of perinatal Deaths	Cardio-pulmonary insufficiency	Multiple organ failure	Respiratory Insufficiency	Cerebral insufficiency	Placental insufficiency	Unknown
Case1	0	0	5	0	0	0
Case 2	0	0	5	0	0	0
Case 3	0	0	5	0	0	0
Case 4	0	0	4	1	0	0
Case 5	2	0	0	0	3	0
Case 6	2	0	2	0	1	0

Kappa= 0.36662, z=4.08,p=< 0.000.

Table 2b. Mechanisms of perinatal deaths among the women determined by the experts using Tulip classification.

All the 5 raters agreed that for cases 1,2 &3, the mechanism for perinatal death was respiratory insufficiency. For case 4,four raters agreed the mechanism was respiratory insufficiency while one thought it was due to cerebral insufficiency. For case 5, while two raters thought the mechanism was cardio-pulmonary insufficiency, remaining 3 thought it was due to placental insufficiency. For case 6, two raters each thought it was due to cardio-pulmonary and respiratory insufficiency respective while only one rater thought it was due to placental insufficiency (Kappa= 0.36662, z=4.08,p=< 0.000). Showing only a fair level agreement among the 5 expert observers.

The effect of antenatal care, birth weight, parity and multiple pregnancies on perinatal mortality among cases of SPEE is shown in table 3.

Factors assessed	Total no of infants	Perinatal death	Perinatal mortality (per 1000 total births)	P value
Antenatal Care				
Booked	8(18.6%)	0(0%)	0	
Unbooked	35(81.4%)	6(100%)	5.84	> 0.05
Birth weight				
<2.5kg	16(37.2%)	5(83.3%)	4.87	
≥2.5kg	27(62.8%)	1(16.7%)	0.97	< 0.05
Parity				
0	17(43.6%)	1(16.7%)	0.97	
1-4	21(53.8%)	4(66.8%)	3.89	
≥ 5	1(2.6%)	1(16.7%)	0.97	< 0.05
Multiple Pregnancy				
Singleton	36(83.7%)	3(50%)	2.92	
Twins	4(9.3%)	0	0	
Higher Order	3(7.0%)	3(50%)	2.92	<0.001

Table 3. Effect of antenatal care, birth weight, parity and multiple pregnancy on perinatal mortality among cases of SPEE.

Death was recorded only among those that were unbooked. However the difference between the two groups (booked vs unbooked was found not to be statistically significant. Low birth weight was also found to contribute significantly to perinatal death among the cohort. Though more number of perinatal deaths were recorded in nulliparae and grand-multiparae women compared to women of low parity, the difference was statistically not significant. Higher order pregnancies were also found to be to be a significant contributor to perinatal mortality.

Tables 4A, 4B and 4C shows the workload indicator for staffing need (WISN) in the labor ward, labor ward theatre and neonatal intensive care unit. The WISN ratio in the labour ward and labour ward theatre were 3.66 and 1.0 respectively. Average of three NIC unit personnel were available to take care of one neonate.

- Total no of births during the study period: 1026.
- Total no of days during the study period: 396.
- Delivery rate per day: 2.7(~3).
- Cadre and no of certified and experienced staff available per day:
  - Nurses/Midwives: 6(2per 8 hour shift).
  - Physicians: 5(*1 Consultant Obstetrician, 2 Senior Registrars,2 Registrars)
- Total no of heath care workers available **(actual**) within each 24 hour period: 11.
- **Require**d no of health care workers to attend to 2.7(~3) parturients within each 24-hour period=3.

Table 4A. The Workload Indicator for staffing need (WISN) in the labour ward.

- Total no of Caesarean sections(C/S) during the study period: 345.
- Total no of days during the study period: 396.
- Caesarean section rate per day: 345/396=0.87 (~1 C/S per day).
- Cadre and no of certified and experienced staff (minimum) that should handle a C/S:
  - Surgeons: 2
  - Perioperative Nurses: 2
  - Anaesthetists: 2.
  - Neonatologist: 1*(except when handling multiple pregnancies).
- Total minimum no of personnel required for a C/S in a teaching hospital: 7
- Total no of personnel available in the labour ward theatre within each 24 hour period for a C/S: 7.

Table 4B. The workload indicator for staffing need in the Labour ward theatre.

- Total no of neonates admitted during the study period: 311.
- Total no of days during the study period: 396.
- Neonatal admission rate per day: 311/396=0.78 (~1 neonate per day).
- Cadre and no of certified and experienced staff covering the NIC UNIT within each 24-hour period:
  - Physicians: 4(1 Consultant Neonatologist, 1 senior registrar,2 registrars.
  - Nurses: 8 (At least 2per 8hour shift).

Table 4C. The workload indicator for staffing need in the Neonatal Intensive Care Unit

4. Discussion

Maternal and fetal outcomes at birth are a sensitive indicator of the status of health systems so also are outcomes for newly born infants within the first week of extra-uterine life. Perinatal mortality is a severe adverse pregnancy outcome that involves death of the fetus in-utero (still-birth) as well as death of the newly born infant within the first week of life. The International Classification of Diseases, 10th revision (ICD-10) refers to fetal deaths and not stillbirths. Fetal death is defined as "death prior to the complete expulsion or extraction from its mother of a product of conception……. The fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles". The measurement focus is on fetal deaths in the last two trimesters of pregnancy and is defined by a birth-weight $\geq$ 500g;if birth-weight is unknown, by gestational age of $\geq$22 completed weeks; or, if both of these criteria are unknown, by crown-heel length of $\geq$ 25cm (WHO,ICD-10,1993).However, for international comparability, WHO recommends reporting of late fetal deaths (third trimester stillbirths at $\geq$1000g birth-weight,$\geq$ 28 completed weeks of gestation, $\geq$35 cm body length)(WHO,1993).Nevertheless, it has also been recommended that outcomes at thresholds lower than 28 weeks may also be reported(WHO,2004). Globally, it has been estimated that about 2.6 million stillbirths occur annually (Cousens,2011).

The continuum of SPEE is still a highly recurrent obstetric complication in Ile-Ife, Nigeria and it has been noted to be accountable for about one-third of maternal deaths in developing countries (Thomas,1998;Makinde,2009). In the same hospital, an analysis revealed a perinatal mortality rate of 77.03 per 1,000 total births in 2003(Kuti,2003). This present study was therefore carried out to know the magnitude of the contribution of SPEE towards perinatal mortality within the hospital. The limitation of hospital based data in the correct assessment of the magnitude of a problem in a general population is recognized, the dearth of nationally collected vital statistics in most low-income countries has made regional surveys impracticable.

Table 1 shows the 6(13.9%) perinatal deaths out of 43 infants delivered by 39 females with SPEE. The perinatal mortality rate (PMR) attributable to SPEE was 5.8 per 1,000 total births since there were 1026 total births during the study period. From a single attributable factor, this PMR is intolerably high. It is noteworthy from Tables 1 and3, that all the 4 mothers with SPEE and 6 perinatal deaths never had ante-natal care (unbooked) whereas there was no perinatal death among the booked cases. All the 4 affected mothers with perinatal deaths were high risk cases namely multiple pregnancy of higher fetal order, primigravidity, grande-multiparity and previous history of perinatal death. Due to the lack of antenatal care by the affected mothers, there was no supervision of their pregnancies neither was there awareness about emergency preparedness and interventions which had dire consequences on their perinates.

Table2a shows the causes of the 6 perinatal deaths during the study period by the Tulip classification method. The first 4 cases were attributable to prematurity while the last 2 were due to placenta and cord anomalies. There was very good inter-rater agreement among the 5 observers with a Fleiss Kappa value of 1.00($z=7.77, p<0.0001$). The estimated gestational ages of the 6 cases of perinatal deaths ranged from 22-36 weeks. This is not surprising since the 4 affected mothers had life-threatening obstetric emergencies like eclampsia which would

have necessitated delivery after initial stabilization. There were 2 fresh stillbirths which were adverse outcomes due to the maternal conditions.

Table2b shows the mechanism of the causes of death. The first 3(the triplets) were attributable to respiratory insufficiency while there were no perfect agreement for cases 4,5 and 6. Overall, the Fleiss Kappa value for mechanism for the causes of death was 0.36662 ($z=4.08$, $p< 0.0001$),this shows that there was fair inter-rater agreement. Knowing the causes of perinatal mortality is essential when designing interventions, and there are at least 35 published classification systems which makes comparison of the systems almost impossible or difficult. The Tulip classification for perinatal mortality allows unambiguous classification of underlying cause and mechanism, gives a good inter-rater agreement, with a low percentage of unknown causes and is easily applicable in a team of clinicians when guidelines are followed(Kortweq,2006).

The TULIP classification attempts to answer the question "why", while Wigglesworth system answers the question" when" and the RECODE answers the question "what". In order to answer these 3 questions related to perinatal mortality, there should be a combination of the classification systems (Kortweq, 2006; Gordjin,2009). Obviously, this would be cumbersome and may be unattainable in many health-care facilities especially in low-income countries.

Table 3A shows the glaring effect of antenatal care on perinatal mortality since antenatal care is one of the pillars of safe-motherhood. None of the booked cases recorded any perinatal death even though all the mothers had SPEE, however, the effect of antenatal care on perinatal mortality was not found to be statistically significant. Table3B shows that preponderantly, low birth-weight infants had a higher perinatal mortality rate(4.87compared with 0.97 per 1000 total births) and this was found to be statistically significant($p<0.05$). Table 3C shows that parous mothers preponderantly experienced a perinatal mortality rate of 3.89 per 1,000 total births compared with 0.97 per 1000 total births respectively for both nulliparous and grande-multiparous mothers. There were more perinatal deaths associated with singleton and pregnancies of higher fetal order than in twins. This was found to be statistically significant with a p value<0.001.

The causes of maternal mortality are often inseparable from causes that lead to perinatal mortality (Pattinson et al, 2011). WHO has identified four main interventions which are critical in efforts to reduce maternal mortality in developing countries namely, family planning, antenatal care, skilled birth attendance and emergency obstetric care. Table 4A, B and C shows the workload indicator for staffing needs (WISN) in the labour ward, labour ward theatre and neonatal intensive care unit of the hospital.

Workload indicator for staffing need is a method that can help planners and managers estimate staff requirements, allocate staff among diverse health facilities, and monitor staff performance (Shipp,1998).The job description of each cadre of staff within a health-care facility to meet acceptable professional standards of service delivery is determined. Thus, the calculated (required) number of staff in a unit is determined based on their activities and compared with the number actually on ground using the WISN ratio. If the WISN ratio is 1.0, i.e actual staff equals calculated staffing requirement, then the current staff is just sufficient to meet the workload according to the professional standards which have been set. If the WISN ratio is < 1.0, then the current staff is not sufficient to meet the standards set and

if the ratio is > 1.0, then there are more than enough staff to meet the standards set. Table 4 A, shows a WISN ratio of 3.66 for the labour ward of the hospital indicating that there are more than enough skilled attendants of different cadres to cope with the deliveries. Table 4B indicates that the labour-ward theatre had a WISN ratio of 1.0 indicating that the staffing strength was just enough to cope with basic and comprehensive emergency obstetric services in the unit.

Progression of pre-eclampsia to eclampsia is an obstetrical emergency. Hypertensive disease of pregnancy has been reported to have 20% antepartum and intrapartum stillbirth effects each(Bhutta,2011; Dolea,2003). It is therefore imperative to detect and manage hypertensive disease in pregnancy promptly and effectively as part of advanced antenatal care. However, this would be possible only if the affected pregnant females access care in a standard health-care facility thus community mobilization and education strategies for promotion of appropriate care seeking should be evolved. In low-income areas, poverty is prevalent, therefore, emergency loans through micro-insurance funds effected through public-private partnerships may be instituted for emergency obstetric care.

The availability of skilled birth attendants adequate numerically on a 24-hour basis is essential to stem the tide of intolerably high maternal and perinatal mortality and morbidity. For such skilled staff, there should be proficiency in partogram usage in labour and neonatal resuscitation and care. An earlier study in our community had shown that proficiency in partograph usage in labour can be achieved by lower cadre health care givers like community health extension workers especially in rural /semi-urban areas(Fatusin, et al,2008).

Prevention of a disease state and its complications is always better. In this study, 26/39 (66.6%) of the mothers were unbooked and a perinatal mortality rate of 5.84 per 1000 total births was recorded all in unbooked mothers. In many high income countries, the perinatal mortality is <10 per 1000 births from various causes. It is therefore glaring that from a single disease entity(SPEE), perinatal mortality rate of 5.84 per 1000 births is intolerably high. In an environment like this, the Pre-eclampsia Community Guidelines (PRECOG) recommendations when adhered to would go a long way in minimizing the incidence and complications of SPEE. The PRECOG provides an evidenced based risk assessment with criteria for early referral for specialist input, a two-tiered schedule for monitoring women in the community after 20 weeks of gestation and referral for stepped-up care(Milne,2005).Chemo-prophylaxis such as antenatal Calcium supplementation and low-dose aspirin(75mg) may also be beneficial in females at risk of hypertensive disease in pregnancy(Bhutta,2011; CLASP study,1994).

5. Conclusion

From this study, with a perinatal mortality rate of 5.84 per 1000 births attributable to a single disease entity, severe pre-eclampsia/eclampsia contributes significantly to perinatal mortality in our environment. Improvement of the quality and coverage of care to reduce maternal and perinatal deaths is complex as both are inextricably linked. Successful implementation of known lifesaving interventions within health system packages requires consideration of many interfaces between individual agents that affect whether the introduction of the packages will be effective. Every interface contributes to reduction of

unnecessary deaths of mothers and their babies. There should also be a high degree of cooperation between policy makers, health promotion managers, the community, patients, health-care providers and managers within the health system to effect needed change to drastically reduce the high maternal and perinatal mortality in our environ.

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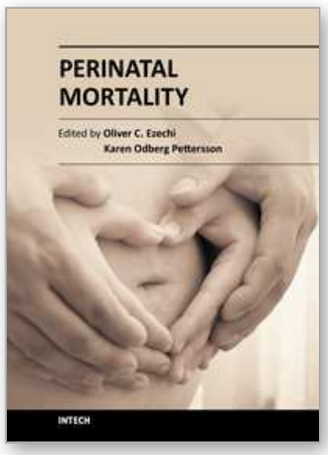
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This book is a compendium of important topics related to perinatal mortality. It has been written for anyone who is interested in perinatal medicine and wishes to be part of the global strategy for prevention and control of perinatal mortality. It covers variety of subjects using simple language that can easily be understood by most health workers and those interested in quality health care. Postgraduate students in midwifery, obstetrics and paediatrics will also find it a very useful companion.

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