ORIGINAL RESEARCH ARTICLE

Prospective Audit of Avoidable Factors in Institutional Stillbirths and Early Neonatal Deaths at Tikur Anbessa Hospital in Addis Ababa, Ethiopia

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Abstract

Mortality audits are being used with increasing frequency to improve health outcomes by pinpointing precisely where deficiencies in clinical care exist. We conducted a prospective audit of stillbirths and early neonatal deaths at Tikur Anbessa Hospital in Addis Ababa, Ethiopia, as part of a broader initiative to reduce perinatal mortality in the labor room and neonatal intensive care unit. Out of 1,225 deliveries that took place during the six-month study period, there were 30 stillbirths and 31 early neonatal deaths (PMR 50/1,000). A multi-disciplinary Audit Team was established and convened monthly to review standardized data collection forms that were completed for each death. It was determined that avoidable factors were present in 70% of perinatal deaths. Health worker-related factors were the most common avoidable factors identified (accounting for 84% of avoidable factors identified), followed by patient-related factors (11%) and administrative-related factors (5%). Based on the study findings, quality improvement programs that target gaps in care are being implemented on the hospital's labor room and in the neonatal intensive care unit.. *(Afr J Reprod Health 2015; 19[4]: 78-86).*

Keywords: Perinatal mortality, Clinical audit, Ethiopia, Developing Countries, Stillbirth

Résumé

La vérification de mortalité sont utilisés avec une fréquence croissante pour améliorer les résultats de santé en identifiant précisément là où existent des lacunes dans les soins cliniques. Nous avons mené une enquête prospective de mort-nés et de décès néonatals précoces à l'Hôpital Tikur Anbessa à Addis-Abeba, en Ethiopie, dans le cadre d'une initiative plus large qui vise à réduire la mortalité périnatale dans la salle de travail et de l'unité de soins intensifs néonatals. Sur 1.225 d'accouchements qui ont eu lieu au cours de la période d'étude de six mois, il y avait 30 enfants mort-nés et 31 décès néonatals précoces (TMP 50/1000). Une équipe de vérification multidisciplinaire a été établie et convoquée mensuellement pour étudier des formulaires normalisés de collecte de données qui ont été réalisées pour chaque décès. Il a été déterminé que les facteurs évitables étaient présents dans 70% des décès périnatals. Les facteurs liés à personnel de santé étaient les facteurs les plus communs des facteurs évitables identifiés (qui représentent 84% des facteurs évitables identifiés), suivis par des facteurs liés au patient (11%) et les facteurs liés à l'administration (5%). En se fondant sur les résultats de l'étude, les programmes d'amélioration de la qualité qui ciblent les lacunes dans les soins ont été mis en œuvre sur la salle de travail de l'hôpital et dans l'unité de soins intensifs néonatals. *(Afr J Reprod Health 2015; 19[4]: 78-86).*

Mots-clés: mortalité périnatale, audit clinique, Ethiopie, pays en développement, mort-nés

Introduction

Rates of perinatal deaths, generally defined as the grouping of stillbirths (greater than 28 weeks gestation) and early neonatal deaths (taking place in the first week of life), indicate to a large degree the capability of any given society to care for women in their reproductive years and to deliver high quality health care to mothers and babies around the time of childbirth[1-4]. An estimated 7.5 million perinatal deaths take place each year in a grossly disproportionate global geographical distributions[1,2,5]. Perinatal mortality rates (PMR) range from less than 10 per 1,000 in most developed countries to up to 60 per 1,000 or more in parts of Africa and Asia[4].

Hospital-based studies in low-income countries have shown that as many as 75% of perinatal deaths may be due directly or indirectly to suboptimal care[6,7]. This highlights the

importance of identifying and addressing factors within local health systems that regularly contribute to poor outcomes. Perinatal mortality audits, in which perinatal deaths are systematically investigated to determine causes of death and the circumstances that lead to them, are increasingly being utilized in low, middle, and high-income countries to pinpoint exactly where deficiencies in care occur so that proven health interventions can be implemented in ways that have greatest impact on patient care[6,8-12].

In Ethiopia, rates of perinatal mortality are high. The latest Demographic and Health Survey (2011) estimated PMR at 46 per 1,000 births (this reflects outcomes of institutional births as well as home births, which are common in Ethiopia)[13]. Absent until now, however, has been a comprehensive understanding of the nature of perinatal deaths in institutional births in Ethiopia, including a systematic assessment of causes of mortality as well as identification of the potentially avoidable contributing factors to those deaths.

The current study was conducted under the auspices of a larger program aimed at reducing perinatal deaths in the delivery room and in the neonatal intensive care unit (NICU) at Tikur Anbessa Hospital (TAH) in Addis Ababa, Ethiopia, which is Ethiopia's premier teaching hospital and national referral center. In this investigation, the authors sought to systematically conduct perinatal audits of all stillbirths and early neonatal deaths at TAH in order to identify avoidable factors in perinatal deaths that could inform the design of targeted interventions aimed at reducing perinatal mortality.

Methods

This was a prospective audit of all perinatal deaths that took place at TAH during a six month period from June to November, 2012. Inclusion criteria were stillbirths with gestational age of 28 completed weeks and weight of 1,000 grams or more who were delivered after maternal admission to the TAH delivery room, and neonatal deaths that occurred in the first seven days of life after being delivered at TAH and who were at least 28 weeks gestation and weighed at least 1000 grams. Exclusion criteria were all late neonatal deaths (after the first week of life) and all neonatal deaths

of babies who were born outside of TAH (e.g., those who were referred from other hospitals, health centers, or home).

Study Site

The study was conducted at TAH, the country's only national referral hospital capable of providing tertiary care to ill newborns in a NICU setting. TAH is located in Addis Ababa and receives patients from the immediate surrounding area as well as neighboring regions. Patients in the delivery room at TAH are managed by senior obstetricians, obstetric resident physicians, interns and midwifes. Approximately 3,500 deliveries take place at TAH each year, many of which are high-risk pregnancies that are referred from outside hospitals. About 60% of deliveries are either caesarian section or instrumental (forceps or vacuum). As a rule, essentially all high-risk neonates are admitted to the TAH NICU and evaluated by the neonatal team. At TAH, high-risk neonates are defined as: birth weight < 1500 grams; gestational age < 34 weeks; requirement for positive pressure ventilation; requirement for an exchange transfusion; suspected infection with clinical signs; apnea, cyanotic episodes, or other respiratory distress causing clinical concern; bile-stained vomiting, other signs suggesting bowel obstruction, or feeding problems severe enough to cause clinical concern; inability to maintain serum glucose concentration greater than or equal to 45 mg/dL despite adequate feeding; convulsion; birth asphyxia; congenital anomalies that may require intervention; cardiovascular problems requiring monitoring or intervention; or any newborn with clinical concerns such that the attending doctor or nurse feels that the baby requires observation or treatment in the NICU.

The TAH NICU is located on the same floor as the delivery room (approximately 30 meters away). Newborns are admitted to the TAH NICU from the delivery room as well as from other hospitals, health centers, and home deliveries. The NICU is staffed by senior pediatricians, neonatal Fellows, pediatric resident interns, and nurses. Periodically, visiting neonatologists and nurses from the United States also work in the TAH NICU through an ongoing collaboration between TAH and the Vermont Oxford Network, a non-

profit voluntary collaboration of health care professionals from more than 900 NICUs around the world dedicated to improving the quality and safety of medical care for newborn infants and their families.

Study Procedures

Identification of cases of stillbirths and early neonatal deaths was made by daily examination of the hospital's birth register. Each case was then thoroughly audited using a standardized data collection form and review by a multi-disciplinary Audit Team.

The standardized data collection form consisted of four parts. Part I included data abstracted from medical records comprised of socio-demographic characteristics and obstetric history. Part II included data obtained by interviews with health staff (i.e., physicians and nurses) involved in the care of the stillbirth or neonate; these interviews were conducted using a pre-tested and structured questionnaire that incorporated a modified verbal autopsy instrument developed by the World Health Organization (WHO). Part III included data obtained by interviews with mothers (or other family members if the mother was unavailable); these interviews were conducted using a pre-tested and structured questionnaire that incorporated a modified verbal autopsy instrument developed by WHO, and were typically made on the day following the death (if the death occurred during a weekend or holiday, then the interviews with mothers or other family members were conducted within the subsequent 1-3 days). Information describing socio-demographic characteristics and reproductive, medical and obstetric risk factors for perinatal mortality were obtained during interviews with family members. The data collection form (and data collection process as a whole) was pre-tested on three cases to ensure its practicality and feasibility prior to initiation of the main investigation.

After Parts I-III of the data collection form was completed, each case was formally presented at a monthly meeting of the Audit Team and discussed amongst the group. The Audit Team, which was established expressly for the purposes of this investigation, was comprised of two obstetricians, the senior midwife in charge of the delivery room, a neonatologist, a neonatal Fellow, and the head nurse of the NICU. The Audit Team determined (a) the diagnosis and immediate cause of death, according to Wigglesworth classifications[14]; (b) its best assessment of whether or not the death was preventable; and (c) if preventable, what specific avoidable factors contributed to the death. The principal investigator (AD) documented findings of the Audit Team for each case on Part IV of the data collection form. The process of determining whether or not a death was avoidable relied upon serious consideration of information derived from multiple inputs (i.e., Parts I-III of the data collection form) and deliberation among members of the Audit Team. When reviewing cases, the Audit Team took particular note of risk factors that are known to be associated with poor outcomes, and how these may have related to missed opportunities to provide standard care practices.

Ethical issues, confidentiality, and data considerations

Ethical approval was obtained by the Department of Pediatrics and Child Health at Addis Ababa University. Informed written consent to participate was obtained from mothers (or other family members) of perinatal deaths that were included in the study. All data were managed in a confidential manner using anonymized patient identification codes. Data were electronically recorded and analyzed using Epi info version 3.5. Duplicate data entry was conducted for 10% of data collection forms for validation purposes. The frequency of PMR was calculated as a rate and reported as number of deaths per 1,000 births.

Results

There were a total of 1,225 deliveries at Tikur Anbessa Hospital during the study period. Two newborns were excluded from the analyses due to missing data and 15 stillbirths were excluded based on predefined criteria (weight being less than 1000 grams or gestation under 28 weeks). Sixty-one perinatal deaths occurred, of which 30 were stillbirths and 31 were early neonatal deaths, corresponding to a PMR of 49.8 per 1,000 births (95% CI of 37.6 -62 per 1000).

Table 1 summarizes the socio-demographic characteristics of parturients who suffered a perinatal death. Most perinatal deaths were associated with women aged 20 to 39 years (95%) and rates of perinatal death were nearly equal in primigravid and multiparous women (48% vs 52%, respectively). With respect to length of gestation, most perinatal deaths occurred at less than 37 weeks of gestation. The majorities (72%) of losses were among women who resided in Addis Ababa, and nearly 80% of women had some level of education. Forty-four percent of births took place by spontaneous vertex delivery whereas emergency cesarean delivery accounted for 43% of deliveries. One stillbirth was delivered by elective cesarean delivery. Among early neonatal deaths, more than half (58%) took place during weekend or off-duty hours and the remaining births (42%) occurred during regular working hours.

Table 2 shows the causes of death of stillbirths and early neonatal deaths. The most common causes were complications of prematurity (accounting for 31% of total deaths) followed by intrapartum-related events that resulted in a neonatal death (accounting for 28% of deaths), acute intrapartum events that resulted in a stillbirth (accounting for 21% of deaths), congenital anomalies (accounting for 23% of deaths), and infection (accounting for 11% of deaths). The main intrapartum-related events that resulted in neonatal deaths or stillbirths were conditions that led to severe fetal distress and perinatal asphyxia, including severe pre-eclampsia, maternal convulsion, placental abruption, and cord accidents. Among stillbirths, 24 (80%) took place before arrival at the hospital; the remaining 6 fetuses (20%) had a detectable heart beat on arrival.

Avoidable factors which either directly or indirectly contributed to perinatal deaths were identified in 43 (70%) of cases. These factors fell into three categories: patient-related factors, administrative-related factors, and health worker-related factors (Table 3). Health worker-related factors were by far the most common factors identified. These included, in descending order of frequency, failure to detect and manage hypothermia; inadequate preparedness of the

NICU team; failure of antenatal steroid administration; delay in decision-making in the labor ward (e.g., delay to decision to conduct operative delivery); delay in referral to higher level hospital (i.e., the patient was not referred in a timely manner to a higher level of service where essential care could be delivered); and inadequate NICU care (e.g., poor hygiene measures, improper sterility during procedures, improper continuous positive airway pressure delivery, and improper feeding). The timing of avoidable factors that resulted in stillbirths all occurred prenatally,

Table 1: Socio-Demographic Characteristics of Women who Suffered a Perinatal Death at Tikur Anbessa Hospital during the Study Period

Characteristic	Stillbirth (n=30)		Early neonatal death (n=31)		Total (n=61)	
	N	%	N	%	N	%
Age						
<20	1	2	0	0	1	2
20-39	27	44	31	51	58	95
≥40	2	3	0	0	2	3
Gestation						
28-33	11	18	18	30	29	48
34-36	3	5	3	5	6	10
≥37	16	26	10	16	26	43
Parity						
1	14	23	15	25	29	48
2-4	15	25	15	25	30	49
≥5	1	2	1	2	2	3
Antenatal visits						
0	3	5	1	2	4	7
1-5	21	34	23	38	44	72
≥5	6	10	7	12	13	21
Delivery mode						
Vaginal	18	30	9	15	27	44
Breech	3	5	0	0	3	5
Instrumental	4	7	0	0	4	7
Cesarean (elective)	1	2	0	0	1	2
Cesarean (emergency)	4	7	22	36	26	43
Address/Domicile						
Addis Ababa	17	28	27	44	44	72
Outside Addis Ababa	13	21	4	7	17	28
Education						
None	8	13	4	7	12	20
Primary school	9	15	11	18	20	33
Secondary school	8	13	14	23	22	36
Higher level education	5	8	2	3	7	12

Table 2: Causes of Stillbirths and Early Neonatal Deaths

Cause of death	N	% within group	% of total
Stillbirth	30	100	49
Acute intrapartum event	13	43	21
Congenital cause	11	37	18
Infection	2	7	3
Other fetal cause	2	7	3
No condition identified	5	17	8
Early neonatal death	31	100	51
Complications of prematurity	19	61	31
Intrapartum-related event	17	55	28
Infection	5	16	8
Congenital abnormalities	3	10	5
Other cause	1	3	2
No condition identified	0	0	0
Total	61		100

Table 3: Avoidable Factors in Stillbirths and Early Neonatal Deaths at Tikur Anbessa Hospital

Avoidable factor	Stillbirth	Early neonatal death	Total (n=61)
Patient-related factors			
No antenatal care	3 (5%)	3 (5%)	6 (10%)
Absent or inadequate antenatal care	1 (2%)	1 (2%)	2 (3%)
Delay in seeking skilled care	2 (3%)	1 (2%)	3 (5%)
Unwanted pregnancy	0 (0%)	1 (2%)	1 (2%)
Other patient-related factor	10 (16%)	1 (2%)	11 (18%)
Administrative-related factors			
Transport difficulties from home to hospital	2 (3%)	0 (%)	2 (3%)
Availability of hospital bed	1 (2%)	(3%)	3 (5%)
Other administrative-related factor	10 (16%)	1 (2%)	11 (18%)
Health worker-related factors			
Failure of antenatal steroid administration	0 (0%)	10 (16%)	10 (16%)
Delay in decision-making in labor ward	2 (3%)	5 (8%)	7 (11%)
Inadequate preparedness of NICU team	0 (0%)	26 (43%)	26 (43%)
Hypothermia	0 (0%)	30 (49%)	30 (49%)
Inadequate NICU care	0 (0%)	5 (8%)	5 (8%)
Delay in referral to higher level hospital	6 (10%)	0 (0%)	6 (10%)

and approximately one-third of avoidable factors that resulted in an early neonatal death took place prenatally. The main postnatal factor was inadequate preparedness of the NICU team, a factor in 32% of neonatal deaths that took place in the first 24 hours of life and 43% of deaths overall. Examples of deficiencies in care that fell into this category included poor planning and discussion between the obstetrics staff and NICU team, unsatisfactory preparation of essential equipment (e.g., neonatal resuscitation equipment) and medicines (e.g., surfactant); and poor availability of skilled newborn health professionals (e.g., capable of providing effective neonatal resuscitation). Postnatal factors also included hypothermia (detected in all but one neonates admitted to the NICU, both at the time of admission and at 24 hours of life), inadequate NICU care (including poorly performed neonatal resuscitation, poor communication among NICU staff between shifts, and poor preterm feeding and parenteral nutrition practices), and delay in transport to the NICU. The most common patient-related avoidable factors were absent or inadequate antenatal care (i.e., less than four antenatal care visits), a factor in 10% of deaths, and delay in seeking skilled care (i.e., failure to seek skilled birth assistance at the onset and progression of labor), a factor in 5% of deaths. Other patient-related avoidable factors generally related to improper knowledge by patients of the childbirth process. Administrative-related factors included transport difficulties and availability of hospital beds, which were contributing factors in 3% and 5% of deaths, respectively. Other administrative-related factors generally related to medicine, supply, or equipment shortages.

Figure 1 shows the cumulative survival among neonates admitted to the NICU who died in the first week of life. The highest number of deaths occurred on the first day of life (31%) and more than half of deaths (54%) occurred within 3 days.

Figure 1: Cumulative Survival of Babies with Early Neonatal Deaths

Discussion

The overall PMR in this study was 49.8 per 1000 births, which is similar to estimates from other studies in Ethiopia[14]. This rate is also comparable to that reported in a similar study conducted in Tanzania, where the introduction of new obstetric policies that were informed in part by audits led to reduced perinatal mortality[15].

The Tanzanian experience was one of many that illustrate how systematic mortality audit processes can be used to identify important existing deficiencies in care, information that is crucial to the rational design of quality improvement programs that increase safety and efficiency of patient care[6,15-19].

We found that avoidable factors in perinatal mortality take place across the continuum of childbirth, from the prenatal period, through labor and delivery, and in the postnatal period. Key deficiencies that were identified include lack of early referral of high-risk mothers and suboptimal management during labor and delivery; inadequate clinical care systems for regularly ensuring effective neonatal resuscitation; poor administration of antenatal steroids when clearly indicated; and poor attention to thermal management leading to neonatal hypothermia.

In our study, 80% of intrauterine deaths occurred before maternal arrival at the hospital, which is a sober reminder of the tragic consequences that can be associated with delay in referring patients promptly and failing to administer and receive high quality antenatal care. Preparedness for high-risk deliveries also emerged as a key contributing factor to perinatal deaths. It is essential that staff qualified in neonatal resuscitation be present at each and every delivery and that the NICU team be notified ahead of the delivery so that preparedness can be ensured for babies that are likely to be sick at the time of birth. At TAH, antenatal steroids are indicated for mothers with threatened delivery at less than 34 weeks gestation. The assessment of gestational age in most cases in our population is straightforward and the medicine is generally available, and so there should be few barriers to adherence to the antenatal steroid protocol. Hypothermia was another commonly identified avoidable factor. We found that babies were hypothermic not just at the

time of admission, but many were also hypothermic 24 hours after admission, which should be preventable in most cases. Hypothermia has been found to be a major independent contributor to early neonatal mortality[20]. It also leads to increased risk of other medical complications (such as delay in fetal-to-newborn circulatory adjustment, acidosis, and coagulation defects) thermal management is fundamental to safe newborn care. Even in settings with limited resources, maintenance of normal temperature in newborns should be achievable through simple interventions including ambient temperature control, skin-to-skin contact, proper wrapping with a warm blanket, and/or use of radiant warmers[21].

Based on the findings of this study, a number of clinical practice changes have been implemented in the delivery room and in the NICU at TAH with the aim of improving perinatal outcomes. The obstetric staff is now committed to increase their efforts to administer antepartum steroids to pregnant mothers who are having inevitable preterm delivery, including in cases of emergency cesarean section deliveries. Refresher courses focused on neonatal resuscitation have been conducted for midwifes and physicians, and are now being planned to take place with increased frequencies. The deficiencies in thermal management of newborns is being addressed by scaling up efforts to implement skin-to-skin contact between mothers and babies in the delivery room, using transport incubators and cellophane wraps to keep babies warm during transfer between the delivery room and the NICU, and increasing use of radiant warmers to maintain a thermoneutral environment in the NICU. Finally, interdepartmental communication has been strengthened. The NICU team is now organized to be involved in all high-risk deliveries at all hours of the day and night, including weekends and holidays, and measures are being taken to ensure that the NICU team participates in counseling, planning, and management of high-risk deliveries. On top of the changes already being implemented at TAH as a result of this study, the process of conducting audits has also brought to light many additional ways that care might be improved in the delivery room and in the NICU in efforts to improve perinatal outcomes. The future direction

is to establish a standing audit committee in the NICU that will conduct regular, weekly neonatal death audits in order to identify problems with existing systems of care. The authors believe that there is a value in stressing the importance of good documentation, with the slogan "not documented not done". Several interventions are possible that we feel may help to decrease risk of nosocomial infection, including further strengthening infection prevention during procedures and minimizing overcrowding of the NICU. The NICU nurses, who in practice spend much more time at the patients' bedside than the physicians, should be empowered with the necessary knowledge and skills to enable them to assess, identify, and act on common newborn problems. The newborn resuscitation skills of all newcomers to the delivery room or NICU (e.g., new midwifes or resident physicians) should be assessed and, if necessary, improved through training courses and hands-on tutorials. Lastly, hospital officials should be notified whenever essential equipment and medications are in short supply or out of stock.

Limitations of this study include its focus on institutional births in a large referral center. As a consequence, the findings are likely to be applicable to other hospitals in Ethiopia and elsewhere in Africa, but the degree to which they are also relevant to births that take place outside of hospitals is unclear. Also, identifying avoidable factors in perinatal mortality through audits is itself complex, but arguably is still a more straightforward activity relative to the process of designing and implementing quality improvement programs that have measurable impact and are sustainable. Achieving behavior change on the part of health workers to improve outcomes is a difficult task, and is one that requires concerted efforts on the part of all clinical staff (including nurses, midwifes, doctors, and physicians-in-training), hospital administrators, and ancillary staff.

Conclusion

Evidence suggests that regularly conducted systematic audits that identify avoidable causes of perinatal deaths and feed findings back to health workers have the potential to improve perinatal outcomes in almost any setting. In our hospital,

the avoidable factors identified and reported in this investigation contributed to perinatal mortality across the continuum of childbirth. These were related to patient behaviors, administrative issues, and health worker practices. The findings of this investigation have implications for health policy and the administration of optimal health care in childbirth settings. Based on the data collected, health system changes have subsequently been implemented that aim to improve patient safety in the delivery room and in the NICU.

Acknowledgments

Contribution of Authors

AD and JS conceived the study. AD, YG, BW, and JS designed the study. AD, YG, and BW collected the data. AD and JS conducted most of the data analyses. AD wrote the first draft of the manuscript. AD, YG, BW, and JS contributed to the manuscript and all approved the final manuscript.

Competing Interests

J. Spector is an employee of the Novartis Institutes for BioMedical Research.

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