THE UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT OF OBSTETRICS AND GYNAECOLOGY

DETERMINANTS OF ADMISSION FOR BIRTH ASPHYXIA AMONG TERM BABIES ADMITTED TO THE NEONATAL INTENSIVE CARE UNIT AT THE UNIVERSITY TEACHING HOSPITAL

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DISSERTATION SUBMITTED TO THE UNIVERSITY OF ZAMBIA IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY

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LUSAKA

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DEDICATION

This dissertation is a special dedication to my dear wife, Christabel Mwamba and our sons Nicholas and Mathews who have always been the source of my inspiration.

DECLARATION

I HEREBY DECLARE THAT THIS DISSERTATION PRESENTED FOR THE DEGREE OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY HAS NOT BEEN PREVIOUSLY SUBMITTED WHOLLY OR IN PART FOR ANY OTHER UNIVERSITY, NOR IS IT BEING CURRENTLY SUBMITTED FOR ANY OTHER DEGREE**.**

SIGNED: …….

DR NICKSON MWANZA

APPROVED BY SUPERVISOR: DR B VWALIKA

……..

STATEMENT

I HEREBY STATE THAT THIS DISSERTATION IS ENTIRELY THE PRODUCT OF MY PERSONAL EFFORT. THE VARIOUS SOURCES TO WHICH I AM INDEBTED HAVE BEEN CLEARLY STATED IN THE ACKNOWLEDGEMENTS AND THE REFERENCES.

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DR NICKSON MWANZA.

APPROVAL

THE DISSERTATION OF DR NICKSON MWANZA HAS BEEN APPROVED AS PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY BY THE UNIVERSITY OF ZAMBIA.

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ABSTRACT

Background: Birth asphyxia is defined as failure to initiate and sustain breathing at birth, and is graded using Apgar Score: Apgar 1-3 severe, 4-6 moderate, 7-10 normal. Various risk factors contribute to birth asphyxia and include high maternal age, parity, postdates, preterm deliveries, prolonged labour and fetal malpresentation, and unemployment, and premature rapture of membranes (PROM). It can be prevented and early referral for complicated cases is recommended. Asphyxia is a major contributor of neonatal admission to (NICU) at UTH and this study aimed to determine the differences in term babies admitted to the UTH with low Apgar score compared to other reasons.

Methodology: A prospective case control study at the UTH, Neonatal intensive care unit (NICU). All term, singleton deliveries born at UTH admitted to NICU were considered and term deliveries admitted to the NICU meeting eligibility criteria were included. **Cases:** term babies with an Apgar score of less than 7. **Controls:** term babies admitted to NICU for any other reasons. Sample size calculated at160 (80 cases and 80 controls). Details of medical and demographic details were abstracted from patient's files, antenatal cards and confirmed from the mother. SPSS version 14 was used for analysis. The dependent variable was low Apgar score (as defined for the cases and controls). Independent variables included maternal, intrapartum and neonatal factors. Comparison between cases and controls assessed using chi-square (odds ratios). Confounders of determinants assessed using multivariate logistic regression. Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee.

Results. There were 71 cases and 76 controls. Cases were defined by their low Apgar score (<7) and controls included grunting respiration (38, 50%), macrosomia (20, 26.5%), and meconium aspiration (11, 14.5%). Cases were more likely than controls to be referred from the clinic, to be young (<25 years), unemployed, primiparous, have a non-cephalic presentation, be admitted at night, and delivered by a junior doctor (SRMO). However, HIV status, past obstetric history, augmentation, delivery by caesarean and sex of baby had no bearing on being a case or control. Using regression analysis to control for potential confounders, being a case was independently associated with a clinic referral (high OR as all cases were clinic referrals), admitted at night (OR 3.34, 95% CI 1.47-7.58), and delivered by an SRMO (OR 13.41, 95% CI 3.49- 51.49).

Conclusions: Health systems are important determinants (referral mechanisms, trained staff, staffing out of hours). This calls for an evaluation of the referral system as all asphyxiated babies had mothers that were clinical referrals. Early referral and delivery at UTH is essential, as is the need for more supervision of junior staff and more staffing out of hours.

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ABBREVIATIONS AND ACRONYMS

ACOG	American College of Obstetricians and Gynecologists
C – Section	Caesarean section
DOB	Date of Birth
F	Female
Hb	Hemoglobin
H/O	History of
HTN	Hypertension
IOL	Induction of labour
JRMO	Junior Resident Medical Officer
Kg	Kilograms
M	Male
NICU	Neonatal intensive care unit
NO	Number
NR	Non Reactive
PIH	Pregnancy Induced Hypertension
PROM	Premature Rapture of Membranes
R	Reactive
SRMO	Senior Resident Medical Officer
SVD	Spontaneous Vaginal Delivery
TOB	Time of Birth
UK	United Kingdom
USA	United States of America
UTH	University Teaching Hospital
WHO	World Health Organization

INTRODUCTION

Birth asphyxia is a serious clinical problem in many developing countries. It is defined as failure to initiate and sustain breathing at birth (Airede & Weeasinghe, 1995) and is a preventable condition occurring during labour, delivery and postpartum period (Muyide, 1989). Mechanism of birth asphyxia during labour, delivery and the immediate postpartum period, include interruption of the umbilical circulation, inadequate perfusion of maternal side of the placenta with hypotension, hypertension and abnormal uterine contractions, impaired maternal oxygenation following cardiopulmonary disease and anaemia, altered placental gas exchange following placental abruption, placental praevia, placental insufficiency, failure of the neonate to accomplish lung inflation and successful transition from fetal to neonatal cardiopulmonary circulation (Carter et al, 1993).

The recognition of birth asphyxia depends on information gained from a carefully taken history and a thorough physical examination with some appropriate laboratory studies when available at the health facility (Airede & Weeasinghe, 1995). Birth asphyxia is the third major cause of the neonatal morbidity and deaths after infections and preterm births (Campbell, 2000). Birth asphyxia is a significant contributor to newborn morbidity and mortality as well as the long-term neurological deficits (e.g. cerebral palsy) (Airede & Weeasinghe, 1995). The severity of birth asphyxia can be graded by use of the Apgar score done at one minute and five minutes. The one-minute Apgar score determines the need for resuscitation whereas that at five minutes determines the prognosis (Gilstrap and Leveno, 1989). The American College of Obstetricians and Gynecologists (ACOG) grade the 5-minute Apgar score as normal if it is 7, 8, 9, or 10; suggestive of moderate asphyxia if it is 4, 5, or 6; and severe asphyxia if it is 1, 2, or 3 (Carter et al, 1993).

Birth asphyxia is a major contributor to the admission of term babies to the neonatal intensive care (NICU) at the University Teaching Hospital in Lusaka, Zambia and no studies have been done to determine why this is so (Phiri, 2003). This observational study used the clinical assessment done by health providers for term babies (more than 37 completed weeks gestation (Campbell, 2000) admitted to NICU with a diagnosis of birth asphyxia. Several factors determine why term babies are born with birth asphyxia and this study endeavored to explore this aspect.

LITERATURE REVIEW

Globally, it is estimated that about 23% of the annual 4 millions neonatal deaths is due to birth asphyxia (WHO report 2006) (Kinoti, 1993).

WHO estimates that 3% of approximately 120 million infants born each year in developing countries develop birth asphyxia and require resuscitation (Kinoti, 1993).

Prematurity is a condition when a baby is born before 37 completed weeks of pregnancy (Campbell, 2000). Premature birth is a serious health problem worldwide. Premature babies are at increased risk for newborn health complications such as breathing problems and even death. Nearly one in ten of the world's babies are born prematurely and about one million die each year as a result. It is a problem concentrated in poor countries (including Zambia) with the vast majority of the nearly 13 million premature babies born each year in Africa and Asia (WHO report released 5 Oct 2009 journal) (Kinoti, 1993).The incidence of birth asphyxia also varies widely depending on the definition used. There is no single or widely accepted definition of birth asphyxia (Levene, 1991). Definitions that have been used in most studies range from abnormalities of the fetal heart rate, presence of fresh meconium, acidosis and hypoxia, abnormal neurological condition of the infant and failure to initiate or sustain respiration after birth(poor Apgar score) (Airede and Weeasinghe, 1995). Birth asphyxia occurs when the protective physiological mechanisms that lessen the pathophysiology of asphyxia have been overwhelmed resulting in acidosis, accumulation of cytotoxic amino acids, generation of oxygen free radicals and calcium intoxication (Constantine and Weaver, 1991). In term babies, this anaerobic metabolism might lead to oedma, neuronal damage and encephalopathy (Constantine and Weaver, 1991). Birth asphyxia may be associated with renal failure, respiratory distress, hepatic damage, necrotizing enterolocolitis, intracranial haemorrhage, heart failure, coagulopathy, seizure, apnoea, abnormal neuromuscular tone and even death (Ronald, 1990).The current assessment of birth asphyxia is made more reliable because it makes use a combination of factors such as early neonatal seizures, presence of fresh meconium, abnormal fetal heart rate, acid base status(scalp pH, umbilical venous or arterial blood gases) and the Apgar score at 1min, 5mins or later (Ronald, 1990).

The Apgar score was described in 1958 by an anesthesiologist Virginia Apgar as a scoring system of assessment of newborn at delivery and the transition from fetal to newborn life (Apgar, 1953).Though not specific it is widely used to define birth asphyxia and also serves as a reference for other diagnostic tests outcomes (Constello, 1994).It can be affected by prematurity, maternal sedation, improper and inconsistent scoring and disorders affecting the neuromuscular system of the newborn (Clark and Hakanson, 1988).

Different factors influence occurrence of prematurity and asphyxia in both rich and poor countries. In Tanzania, one of the common cause s of newborn death is birth asphyxia which contribute as much as 27% of neonatal deaths (Launch of the helping babies breathe programme, 2009) (Siwila et al, 2009).

In the UK prematurity and birth asphyxia where among the top four commonest causes of perinatal mortality in 1996 and accounted for 22% and 10% respectively (Campbell, 2000).

The seriousness of premature birth cannot be ignored as it predisposes the baby to a variety of acute serious health conditions such as respiratory infections, jaundice, necrotizing enterocolitis, patent ductus arteriosus, hypoglycaemia and hypothermia, and neonatal death. Many premature babies now grow to fully functional adults (Levene, 1991).

Every year about 70% of neonatal deaths (almost 3 million) happen because effective yet simple interventions do not reach those most in need. Coverage of interventions is low, progress in scaling up is slow and inequity is high especially skilled clinical care interventions. Situations vary between and within countries and there is no single solution to saving lives of newborn babies. To scale up neonatal care, two interlinked processes are required, a systemic data driven decision-making process and a participatory right based policy process (Siwila et al, 2009).

It is estimated that birth asphyxia and prematurity accounts for 24% and 14% of perinatal morbidity respectively (Low, 1995). Children who survive birth asphyxia live with chronic neural developmental morbidities including cerebral palsy, mental retardation and learning disabilities (Ronald, 1990). According to (WHO 2005), globally the main direct causes of neonatal death are estimated to be preterm birth 28% and asphyxia 23%. (Siwila et al, 2009). WHO estimate that 3% of the approximated 120 million infants born each year in

developing countries develop birth asphyxia and require resuscitation (Siwila et al, 2009). The risk of dying due to birth asphyxia varies between countries and babies in high neonatal mortality rates countries have an estimated eight times higher risk than babies in low neonatal mortality settings (Ronald, 1990). Based on literature search of published studies from 20 developing countries from 1989-2004, it is estimated that 24%-61% of perinatal mortality is attributed to asphyxia (Siwila et al, 2009) .The cause specific perinatal mortality rate associated with asphyxia is generally between 10 and 20 per 1000births (ICCDR, B publication2009) (Siwila et al, 2009).

The risk factors for birth asphyxia in hospital setting in developing countries have been categorized in Antepartum 50%,Intrapartum 40% and postpartum (infant perinatal) 10% (ICCDR) ,B 2009).The causes are:

A) ANTEPARTUM

-Primiparity

-maternal fever

-PIH

-Anaemia

-Antepartum haemorrhage

-History of previous neonatal death

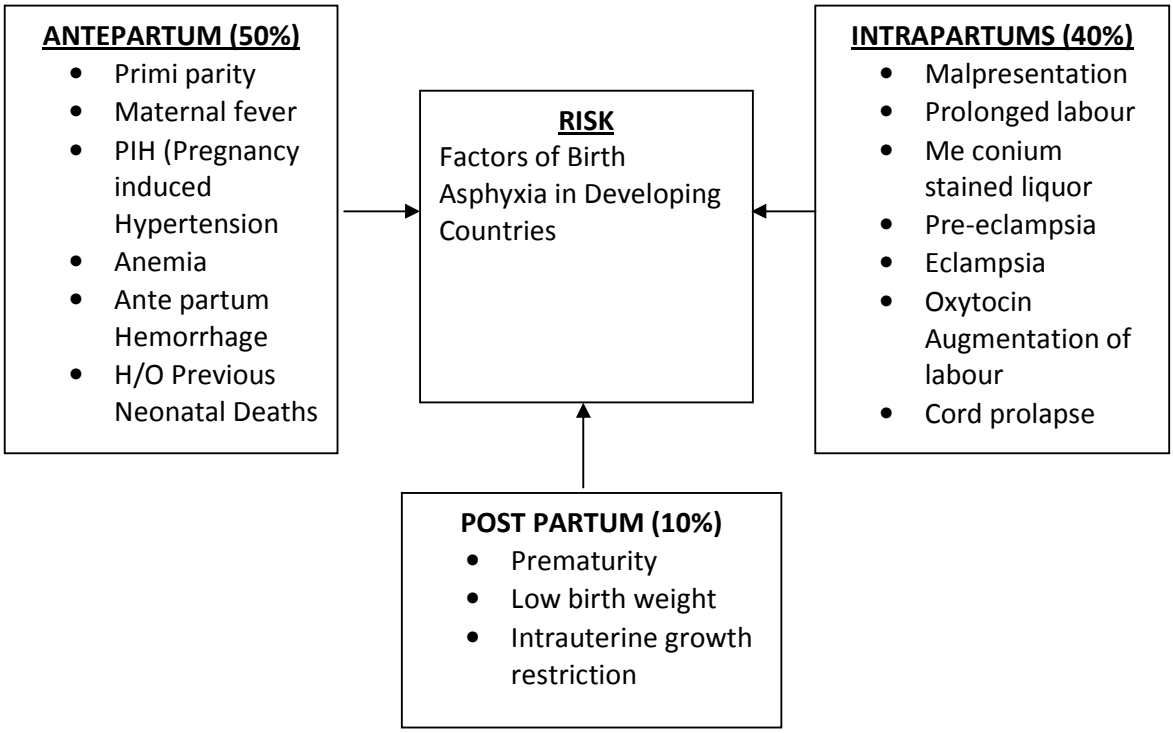
B) INTRAPARTUM

- Malpresentation
- Prolonged labour
- meconium stained liquor
- pre eclampsia
- eclampsia
- oxytocin augmentation of labour
- umbilical cord prolapse

C) INFANT FACTORS

- prematurity
- low birth weight
- intrauterine growth restriction (Low,1975)

CONCEPTUAL FRAMEWORK FOR RISK FACTORS FOR BIRTH ASPHYXIA IN DEVELOPING COUNTRIES



Most premature babies require care in a newborn intensive care unit (NICU) which has specialized medical staff and equipment that can deal with the multiple problems faced by premature infants. Premature babies also face an increased risk of lasting disabilities such as mental retardation, learning and behavioral problems, cerebral palsy, lung problems, vision and hearing loss. Two recent studies suggest that, babies born very prematurely may be at increased risk of certain adult health conditions such as diabetes, high blood pressure and heart diseases (Levene, 1991). Researchers have identified some risk factors, but providers still cannot predict which women will deliver prematurely. Some of the risks include

- Women who have had previous premature delivery
- Women who are pregnant with multiple pregnancy
- Women with certain uterine or cervical abnormalities

- Early age deliveries
- Certain life style factors may put woman at greater risk for preterm labour
- late or no prenatal and antenatal care
- Smoking and drinking alcohol
- Exposure to certain drugs
- Domestic violence (including physical, sexual or emotional abuse
- Extremely high level of stress
- Lack of social support
- Long working hours with strenuous work

Diseases: including urinary tract infections, sexually transmitted infections, Diabetes mellitus, hypertension, clotting disorders (thrombophilia).Being underweight before conception, obesity, birth defects in the baby, vaginal bleeding, younger than 18years or older than 35years and low social economic status.

In Tanzania about 79% of neonatal deaths had low Apgar score and most common causes of neonatal mortality were birth asphyxia (37%) and prematurity (29%)) – (Kidanto et al 2003, Muhimbili National Hospital) (Siwila et al,2009).

Several literatures have looked at the problem and various factors contributing to these cases of birth asphyxia and prematurity all over the world (Siwila et al, 2009).It is therefore an interest of this study to look at the magnitude of the problem in a tertiary hospital setting where health facilities and obstetricians, and paediatric specialists are available and most of the population have access to quality health care services. From the obstetric point of view, there is some evidence that giving the mother steroids 24hrs before preterm delivery will reduce the baby's risk of developing respiratory distress syndrome and reduce perinatal morbidity and mortality (Campbell, 2000).

In addition, advances in neonatal care have improved the survival of many premature infants and this has resulted in vigorous attempts to resuscitate even more grossly premature fetuses (Campbell, 2000).

In the UK prematurity and birth asphyxia where among the top four causes of perinatal mortality in 1996 accounting for 22% and 10% respectively (Campbell, 2000). Birth asphyxia is said to contribute 3-13% of cerebral palsy in developed countries (Low, 1975). A study conducted in USA revealed that the incidence of intrapartum asphyxia

was 2.3% and most of the intrapartum asphyxia occurred in risk pregnancies such history of previous stillbirth or neonatal death, postdates, preterm deliveries, prolonged labour and fetal malpresentation (Low, 1975). A case control study of antepartum risk factors for newborn encephalopathy in term babies conducted in Western Australia found the prevalence of severe or moderate encephalopathy to be 3.18/1000 and the risk was associated with high maternal age and parity, and unemployment. Other risk factors noted in this Australian study were pre-eclampsia, viral infection, Antepartum haemorhage and family history of seizures (Badawi et al, 1998). In another similar study, the intrapartum risk factors were reported as persistent occipital posterior position, maternal pyrexia and acute intrapartum events (Badawi et al, 1998).

An epidemiological study of prenatal loss in rural Maharashtra, India, found that low birth weight and asphyxia were the most important determinants of perinatal mortality and acute birth asphyxia was commonly associated with hypertensive pregnancy disorders, malpresentation and prolonged labour(Dara and Daga, 1983).

In a study conducted in 1983 at Kenyatta National Hospital newborn unit, prematurity, respiratory distress syndrome, perinatal asphyxia and infections were noted as the major causes of mortality (Kasirye and Musoke, 1992). Another study done in Kenya in 1983 at Eldoret District Hospital concluded that intrapartum asphyxia was the commonest probable cause of death and accounted for 45.8% of all still birth (Were, 1994).

In Uganda, a study done at Mulago Hospital birth asphyxia was by far the commonest form of birth trauma and the main cause of mortality (Mukasa, 1993). A retrospective study in South Africa designed to investigate the antenatal and intrapartum management of labour and whose aim was to identify potential risk factors that were likely to lead to birth asphyxia found the incidence of birth asphyxia to be 46/1000 and prolonged labour, prelabour rapture of membranes and meconium staining of liquor associated with other signs of fetal distress were the main risk factors that resulted into significant morbidity and mortality (Hall, 1996).

A prospective study of neonatal death at Oguni State University Teaching Hospital in Nigeria found the perinatal mortality rate to be 50/1000 and the leading cause of death

were birth asphyxia, infection and respiratory distress syndrome. The causes of birth asphyxia in full term babies were noted to be prolonged and obstructed labour, post term delivery and intrapartum accidents (Njokanna & Olan, 1995).

In a multicentre study on birth asphyxia in East and Central African countries, obstetric factors that contributed to asphyxia of the newborns included prolonged labour, malpresentation, intrapartum accidents and hypertensive disorders of pregnancy (Kinoti, 1993).

In Zambia, a prospective study on perinatal and neonatal morbidity and mortality conducted in 1976 showed that the main causes of death were asphyxia, infection, respiratory distress and congenital malformations (Chintu and Shukhani, 1978).

The studies conducted in African countries tend to support the notion that birth asphyxia is avoidable. However, literature review from developed countries like the USA suggests to the contrary that birth asphyxia is unavoidable and unrelated to the intrapartum management of labour (Mati et al, 1983).

A study that audited perinatal mortality in Zimbabwe concluded that the commonest single cause of death was perinatal asphyxia and an avoidable factor was detectable in 76% of the cases (Muyider, 1989). A similar study done in Nairobi, Kenya, showed that 50% of perinatal morbidity and mortality is preventable (Mati et al, 1983).A review of birth asphyxia and subsequent cerebral palsy rate at a Teaching Hospital in South Africa noted that 46% of birth asphyxia cases were preventable and suggested that improved antenatal assessment, monitoring of labour and early referral for complicated cases to a Tertiary care Hospital would help to reduce this number (Gregersen et al, 1999).

A study that evaluated the role of the identification, cause, and avoidable factor solution method of perinatal audit in reducing perinatal mortality conducted at Livingstone Hospital in South Africa found that 50% of perinatal asphyxia was avoidable and the major primary obstetric causes of perinatal loss amenable to intervention were intrapartum, trauma and infections (Ward et al, 1995).

It is estimated that about 6% of all newborns delivered in the United States require some type of neonatal resuscitation (Leuthner et al, 1994). Appropriate and adequate

neonatal resuscitation can prevent morbidity and from birth asphyxia such that even severely compromised infants may survive with less sequelae (Scott, 1976). By identifying avoidable risk factors such as those related to the antenatal care , management of labour and some administrative problems, the incidence of birth asphyxia and therefore the perinatal morbidity and mortality rate of the newborn can be reduced (Patterson and Mack, 1995).

STATEMENT OF THE PROBLEM

Birth asphyxia is a global problem with sequelae regarding morbidity and mortality (Airede & Weeasinghe, 1995). The condition has long-term neurological effects, which are almost untreatable once they occur, so it is better to prevent this condition before it happens. The impact of long-term neurological effects is of utmost importance because it creates tremendous psychosocial and economical burden for the family and the community. The incidence of birth asphyxia at UTH with an Apgar score of 6 was 50/1000 live births in 2003. For term babies alone the incidence was 43/1000 live births(Phiri,2003).In 1999 ,29.3% and 28% of newborn admission to intensive care unit were due to birth asphyxia and prematurity respectively (Phiri,2003). From the above figures, a trend is seen of an increasing number of admissions to NICU due to asphyxia. It is not uncommon for premature babies to be admitted to the neonatal intensive care unit because these are susceptible to so many complications compared to term infant but there is the need to explore reasons why more term babies are getting admitted for birth asphyxia than preterm babies at this tertiary institution of health care which is equipped with specialized manpower and health facilities.

STUDY JUSTIFICATION

Achieving the millennium development goal number four (MDG4); (reduce child mortality) will remain a pipe dream if ways of reducing perinatal mortality are not found. Birth asphyxia is one of the main contributors to this perinatal mortality. Identification of risk factors contributing to birth asphyxia in term babies will go a long way in reducing the morbidity and mortality associated with this condition since asphyxia has been proven to be preventable through sound antenatal care, skilled management of labour and delivery as well as adequate and appropriate resuscitation. The findings of this study will provide useful information that will enable policy makers and stakeholders to address issues around perinatal mortality and develop strategies for achieving the millennium development goal number four (reduce child mortality). These interventions will in the long-term further help to reduce the physical, social and mental disabilities. More resources spent on treatment of complications of asphyxia can then be channeled to prevention of asphyxia.

RESEARCH QUESTION

Are the determinants of admission for birth asphyxia to the UTH NICU for term babies different from term babies admitted for other reasons?

HYPOTHESIS

For term babies, factors associated with admission for birth asphyxia to the UTH NICU are not different from term babies admitted to the same unit for other reasons.

GENERAL OBJECTIVE

To explore the determinants of admission to the neonatal intensive care unit for asphyxia among term babies at the University Teaching Hospital.

SPECIFIC OBJECTIVES

For term babies admitted to the neonatal intensive care unit at UTH:

1. To describe the patterns of clinical diagnosis of asphyxia by clinical staff
2. To determine the social demographic factors of mothers
3. To identify the antepartum and intrapartum risk factors

METHODOLOGY

STUDY DESIGN

The study was a prospective case-control study conducted between October 2012 and Feb 2013.

Cases were term babies ($\geq$ 37 weeks gestation by sure dates) born with an Apgar score of less than seven (i.e. score of 1 through 6) at five minutes.

Controls were singleton term babies admitted to NICU for any other reason.

STUDY SITE

The study was conducted at the University Teaching Hospital Department of Obstetrics and Gynecology labour ward and neonatal intensive care unit (NICU) of the Department of Paediatrics. The UTH labour ward is located near the neonatal intensive care unit.

The University Teaching Hospital is the largest tertiary public health institution in Zambia and it is situated in Lusaka, the capital city of the country. Lusaka urban has a catchment population of 2 million and about 17,000 deliveries are conducted at UTH annually while another 36,000 occur at other clinics which provide maternity services in Lusaka. All patients with complications at the maternity clinics are referred to UTH. Similarly, the neonatal intensive care unit is the only one that serves the whole of Lusaka.

TARGET POPULATION

This consisted of all term, singleton deliveries occurring in Lusaka admitted to NICU. From these both cases and controls were selected.

STUDY POPULATION

This was a group of term deliveries admitted to the NICU with an Apgar score of less than seven and who met the eligibility criteria and term babies admitted for any other reasons. Cases and controls were recruited from this study population.

INCLUSION CRITERIA:

- All term babies born at UTH labour ward and admitted to neonatal intensive care unit with low Apgar score suggestive of birth asphyxia and term babies with any other diagnoses.
- Term gestation was defined as 37 completed weeks as calculated from the last normal menstrual cycle.
- Asphyxia was defined as babies born with an Apgar score of less than seven (7).
- Mothers of the neonates that were aged 18 years or older.

EXCLUSION CRITERIA:

- Premature babies
- unknown gestational age
- congenital abnormalities
- multiple pregnancies
- babies born outside the University Teaching Hospital
- Maternal age less than 18 years

SAMPLE SIZE AND SAMPLING TECHNIQUE

Using the formula for sample size for unmatched case control study:

The two-sided confidence level (1-alpha)	95
Power (% chance of detecting)	80
Ratio of control to cases	1
Hypothetical proportion of controls with exposure	5
Hypothetical proportion of cases with exposure	20
Least extreme odds Ratio to be detected	4.75

The total sample size was estimated to be 154 Adjusting for non-response gives a sample size of 160 (80 cases and 80 controls).

STUDY PROCEDURES

Each morning all babies admitted to NICU were identified for possible enrolment in the study. Any term baby meeting the eligibility criteria was included in the study and either recruited as a 'case' or a 'control'. The mother of each neonate was invited to participate in the study to obtain any of their medical and demographic details. Sources of data also included patient's files, antenatal cards, labour ward registers and doctors morning report books. The data was collected using a standardized structured questionnaire (see Appendix)

DATA ANALYSIS

The dependent variable was admission to the NICU (as defined for the cases and controls). However, cases and controls differed in that cases had an Apgar score less than 7.

Independent variables included those on:

- **Mother:**, Socio-economic status, details of pregnancy including antenatal period, indications of referral, labour and delivery.

  (Maternal factors such as age, parity, gravidity, occupation, education status, antenatal visits, antepartum medical disorders, past obstetric history, and gestational age at time of delivery. Intrapartum information regarding progress of labour included duration of labour, presentation, PROM >24hrs, meconium staining of liquor, fetal condition, intrapartum accidents, mode of delivery and cadre conducting delivery.

- **Neonatal:** including resuscitation, birth weight, and sex of neonate.

(Note, the outcome Apgar score was the dependent variable that differentiated cases and controls).

Data was entered into an Excel spreadsheet. Range and consistency checks were performed to identify any errors during data entry. The data was then transferred into SPSS version 14 for analysis.

Results are presented as tables stratified by case and control. Means and medians have been calculated where appropriate. Chi square (or Fischer exact test if number <5) was used to compare categorical data between cases and controls. The Chi square was used when the independent variable had two categories. The chi-square for trend was used when there were more than two categories that were ordered otherwise the Fischer-Freeman exact test for independence (between cases and controls) was used. Significance was set at $p<0.05$ and 95% confidence intervals were presented as relevant.

LOGISTIC REGRESSION

All maternal and neonatal variables were used to test for and identify plausible determinants to explain reasons for term neonates becoming cases (Apgar score <7) compared to controls (other reasons for admission to NICU) using logistic regression to control for potential confounders.

ETHICAL CONSIDERATIONS

Permission to conduct this study was obtained from the UTH management through the head of department of obstetrics and gynecology. Ethical approval was obtained from the University of Zambia Biomedical Research Ethics Committee. All measures were taken to ensure strict confidentiality. There were no personal identifiers on the data collection tool as only file numbers were used. The publication and scientific presentation of the research findings are in aggregates and without the identification of the individual participants. The study provided continued psychosocial counseling in terms of management and complications of birth asphyxia during the study.

RESULTS

All results are presented in tabular form stratified by cases and controls. Where appropriate multiple categories of a variable were also dichtomised.

Table 1: Cases and controls by Socio-economic variables

	Cases (n=71)	Controls (76)	Statistic
Maternal age 18-19 20-24 25-29 30-34 35-39 40-44 >45	 12 (16.9) 25 (35.2) 14 (19.7) 11 (15.5) 7 (9.9) 2 (2.8) 0 (0)	 7 (9.2) 15 (19.7) 15 (19.7) 30 (39.5) 9 (11.8) 0 (0) 0 (0)	Chi-square for linear trend (M^2) = 6.62 DF = 1 P = 0.01
Maternal age (dichotomous) 18-24 >25	 37 34	 22 54	Chi square = 7.26 P= 0.007 Odds Ratio = 2.67 95% confidence interval = 1.35 to 5.27
Maternal age Mean SD Minimum Maximum median	 26.0 6.46 18 41 24	 28.1 5.47 18 38 30	t-test: One sided P = 0.015 Controls statistically older
Education Status None Primary Secondary Tertiary	 1 (1.4) 27 (38.0) 35 (49.3) 8 (11.3)	 1 (1.3) 30 (39.5) 24 (31.6) 21 (27.6)	Chi-square for linear trend (M^2) = 1.4 DF = 1 P = 0.236
RESIDENTIAL AREA Low Medium High Rural	 41 (57.7) 23 (32.4) 3 (4.2) 4 (5.6)	 34 (44.7) 22 (28.9) 12 (15.8) 8 (10.5)	Chi-square for linear trend (M^2) = 4.9 DF = 1 P = 0.027
OCCUPATION			

	Cases (n=71)	Controls (76)	Statistic
Housewife Formal employment Self employed Schoolgirl unemployed Unknown	41 (57.7) 5 (7.0) 2 (2.8) 11 (15.5) 11 (15.5) 1 (1.4)	55 (72.4) 12 (15.8) 4 (5.3) 5 (6.6) 0 (0) 0 (0)	More cases were schoolgirls or unemployed
OCCUPATION (dichotomous) schoolgirl not schoolgirl	 11 60	 5 71	Chi square = 2.16 P=0.142 Odds Ratio = 2.6 95% confidence interval = 0.86 to 7.91
OCCUPATION (dichotomous) Unemployed other	 11 60	 0 76	N/A since one cell had zero

Table 2: Cases and controls by pregnancy and antenatal variables

	Cases (n=71)	Controls (76)	statistic
PARITY PRIMIPARA MULTIPARA GRAND MULTIPARA (≥4)	 48 9 14	 36 35 5	Chi-square for linear trend (M^2) = 0.36 DF = 1 P = 0.547
PARITY (dichotomous) PRIMIPARA MULTIPARA GRAND MULTIPARA (≥4)	 48 (67.6) 23 (32.4)	 36 (47.4) 40 (52.6)	Chi-square = 5.34 P = 0.021 Odds Ratio = 2.32 95% confidence interval = 1.19 to 4.53
GESTATIONAL AGE (dichotomous) 37,38,39 weeks 40, 40+	 52 (73.2) 19 (26.8)	 42 (55.3) 34 (44.7)	Chi-square = 4.39 P = 0.036 Odds Ratio = 2.22 95% confidence interval = 1.11 to 4.43
ANTENATAL ATTENDANCE (NUMBER OF VISITS) 0 (None) 1 2,3 4 or more	 0 1 29 41	 0 0 33 43	**Considering only more than 1 visit.** Chi-square = 5.74E-03 P = 0.94 Odds Ratio = 0.92 95% confidence interval = 0.48 to 1.78
HIV SEROSTATUS NR R UNKNOWN	 58 11 2	 59 10 7	Chi-square = 0.06 P = 0.813 Odds Ratio = 1.12 95% confidence interval = 0.44 to 2.84
Hb ESTIMATION <11 ≥11 Hb not done	 2 50 19	 7 33 36	Odds ratio = 0.19 Exact Fisher 95% confidence interval = 0.02 to 1.09 Exact Fisher one sided P = 0.033, two sided P = 0.038

	Cases (n=71)	Controls (76)	statistic
Past delivery details			Odds ratio = 0.32
Primiparous (N/A)	48 (N/A)	36 (N/A)	Exact Fisher 95% confidence interval = 6.44E-03 to 3.17
SVD	22	35	
Instrumental	0	0	Less risk of a case compared to a control being a caesarean
Caesarean	1	5	
Last antenatal weight			Chi-square for linear trend (M^2) = 9.71 DF = 1 P = 0.002 (cases heavier)
<60kg	10	21	
60-75	17	19	
75+	46	25	
missing	3	6	
REFERRAL			Observed odds ratio = infinity
Self Referral	0	9	Exact Fisher 95% confidence interval = 3.37 to infinity
Clinic Referral	71	55	Exact Fisher one sided P < 0.001, two sided P < 0.001
UTH Booked	0	12	
REASONS FOR REFERRAL			126 of 147 neonates referred from clinics (71 cases and 55 controls).
Prolonged labour	20	15	The reasons for admission listed by commonest to least common.
Eclampsia	9	0	
PIH	8	7	
Malpresentation	8	0	
CPD	7	4	
Big baby	5	7	
PROM	4	0	
Pre-eclampsia	3	4	
Transverse lie	2	0	
Previous CS	2	7	
?IUFD	1	0	
Oedematous cervix	1	0	
Postdates	1	1	
Abdominal pains	0	1	
APH	0	2	
Deaf and dumb	0	1	
Fetal distress	0	3	
Genital warts	0	1	
Last delivery >10yrs	0	1	
BOH	0	1	
Total	**71**	**55**	

	Cases (n=71)	Controls (76)	statistic
UTH diagnosis			
CPD	5 (7)	5 (9.1)	
Eclampsia	9 (12.7)	0 (0)	
Pre-eclampsia	9 (12.0)	5 (9.1)	
PIH	0 (0)	4 (7.3)	
Fetal distress	1 (1.4)	4 (7.3)	
Malpresentation	10 (14.1)	0 (0)	
normal labour	34 (47.9)	29 (52.7)	
Previous CS	2 (2.8)	7 (12.7)	
PROM	1 (1.4)	0 (0)	
Grandmultipara	0 (0)	1 (1.8)	
Total	**71(100)**	**55 (100)**	
Duration - referral to time seen at UTH			Chi-square for linear trend (M^2) = 1.09 DF = 1
<1hour	3	0	
1-2hrs	26	21	P = 0.297
2-5hrs	31	20	
>5hrs	11	13	
Total	71	55	
N/A	0	22	
Time seen at UTH (dichotomous)			Chi^2 = 13.97 P < 0.001 Odds Ratio = 3.82
Night (17-8hrs)	49	28	
Morning (8-17hrs)	22	48	95% confidence interval = 1.92 to 7.58

Table 3: Cases and controls by labour and delivery variables

	Cases (n=71)	Controls (76)	statistic
Spontaneous labour or induced Spontaneous Induced	 67 (94.4) 4 (5.6) PE/Eclamp	 72 (94.7) 4 (5.3)	Odds Ratio = 0.93 Fisher exact 95% confidence interval = 0.17 to 5.21 Exact Fisher one sided P = 0.602, two sided P > 0.999
Presentation Breech Cephalic Other (Transverse lie)	 5 61 5	 3 73 0	NOMINAL INDEPENDENCE Chi-square = 6.41 G-square = 8.34 Fisher-Freeman-Halton exact P = 0.034
Presentation (dichotomous) Not cephalic Cephalic	 10 61	 3 73	Odds Ratio = 3.99 Exact Fisher two sided P = 0.041 mid-P exact 95% confidence interval = 1.09 to 18.56
Augmented Yes No **Total** N/A	 17 (25.4) 50 (74.6) 67 (100) 4	 22 (31) 49 (69) 71 (100) 5	Chi^2 = 0.29 P = 0.587 Odds Ratio = 0.76 95% confidence interval = 0.36 to 1.6
Duration of labour <10hrs 10-20hrs 20+hrs **Total** N/A (e.g. eclampsia)	 9 48 10 67 4	 16 39 16 71 5	Chi-square for linear trend (M^2) = 0.02 DF = 1 P = 0.886
Duration of labour >10hrs <10 hrs **Total**	 58 9	 55 16	Chi^2 = 1.36 P = 0.243 Odds Ratio = 1.87 95% confidence interval = 0.77 to 4.59

	Cases (n=71)	Controls (76)	statistic
MECONIUM STAINED LIQUOR IN LABOUR Absent Old Fresh	 30 35 6	 52 17 7	NOMINAL INDEPENDENCE Chi-square = 12.05 G-square = 12.24 Fisher-Freeman-Halton exact P = 0.002 Controls more likely to have absent meconium or old meconium compared to cases.
MECONIUM STAINED LIQUOR IN LABOUR (dichotomous) Absent or Old Fresh	 65 6	 69 7	$Chi^2 = 0$ P > 0.999 Odds Ratio = 1.1 95% confidence interval = 0.35 to 3.44
Fetal distress (fresh mec and FHR) (dichotomous) Yes NO	 11 (15.5) 60 (84.5)	 8 (10.5) 68 (89.5)	$Chi^2 = 0.42$ P = 0.515 Odds Ratio = 1.56 95% confidence interval = 0.59 to 4.13
Analgesia (pethidine) (dichotomous) Yes No	 9 62	 14 62	$Chi^2 = 0.53$ P = 0.465 Odds Ratio = 0.64 95% confidence interval = 0.26 to 1.59
MODE of Delivery SVD Instrumental Caesarian section	 33 5 33	 42 4 34	Chi-square for linear trend (M^2) = 0.4 DF = 1 P = 0.528 Fisher-Freeman-Halton exact P = 0.752
MODE of Delivery (dichotomous) Caesarian section No caesarean	 33 38	 34 46	$Chi^2 = 0.11$ P = 0.744 Odds Ratio = 1.17 95% confidence interval = 0.62 to 2.24

	Cases (n=71)	Controls (76)	statistic
INDICATIONS FOR CAESARIAN SECTION			
Prev CS	2	6	
APH	0	2	
CPD	10	11	
FETAL DISTRESS	6	7	
ECLAMPSIA	3	1	
SEVERE P/E	0	0	
BREECH	0	0	
TRANSVERSE LIE	4	0	
OTHERS	8	7	
Total	**33**	**34**	
Decision to CS time			Chi-square for linear trend (M^2) = 2.74 DF = 1
<1hr	2	2	
Between 1-2 hrs	4	8	
Between 2-3 hrs	6	10	P = 0.098
>3 hrs	21	14	
Total	**33**	**35**	
Decision to CS time (dichotomous)			Chi^2 = 0.96 P = 0.327 Odds Ratio = 2.06
Longer than 2hrs	27	24	95% confidence
Less than 2 hours	6	10	interval = 0.66 to 6.43
Person delivering			Chi-square for linear trend (M^2) = 0.37 DF = 1
Midwife	28	38	
JRMO	0	1	
SRMO	26	4	P = 0.542
Registrar	17	32	
Sn Reg	0	1	Fisher-Freeman-Halton exact P <0.001
Consultant	0	0	
Total	**71**	**76**	
Person delivering (dichotomous)			Chi^2 = 1.26 P = 0.262 Odds Ratio = 0.65
Midwife	28	38	95% confidence
Other	43	38	interval = 0.34 to 1.25
Person delivering (dichotomous)			Chi^2 = 20.33 P < 0.001 Odds Ratio = 10.4
SRMO	26	4	Exact Fisher one
Other	45	72	sided P < 0.001,
Person delivering (dichotomous)			Chi^2 = 4.66 P = 0.031 Odds Ratio = 0.43
Registrar	17	32	95% confidence
Other	54	44	interval = 0.21 to 0.88

Table 4: Cases and controls by outcome (i.e. case or control) and other ancillary characteristics

	Cases (n=71)	Controls (76)	Statistic
Main outcome (case or control as defined by Apgar score)			
APGAR SCORE 1 – 3 4 -6 7-10	 36 35 0	 0 0 76	**This is the case and control definition;** test statistic N/A
Ancillary characteristics of cases and controls			
Sex of baby Male Female	 42 29	 46 30	Chi^2 = 1.31E-06 P > 0.999 Odds Ratio = 0.94 95% confidence interval = 0.49 to 1.83
Suction Yes No	 2 69	 3 73	odds ratio = 0.71 Exact Fisher 95% confidence interval = 0.06 to 6.37 Exact Fisher one sided P = 0.532
Oxygen Yes No	 0 71	 14 62	**N/A** Observed odds ratio = 0 Exact Fisher 95% confidence interval = 0 to 0.28 Exact Fisher one sided P < 0.001, two sided P < 0.001
Intubation Yes No	 2 69	 0 76	**N/A** Observed odds ratio = infinity Exact Fisher 95% confidence interval = 0.2 to infinity Exact Fisher one sided P = 0.232, two sided P = 0.232

	Cases (n=71)	Controls (76)	Statistic
Resuscitation drugs Yes No	 4 (2adrenalin; 2 dextrose) 67	 0 76	**N/A** Observed odds ratio = infinity Exact Fisher 95% confidence interval = 0.72 to infinity Exact Fisher one sided P = 0.052, two sided P = 0.052
Birth weight Mean SD Minimum Maximum median	 3233 473.2 2204 4275 3211	 3564 693.1 2425 5500 3425	 P=001 (student t test) **Control babies heavier**
BIRTH WEIGHT 2000-2499 2500-2999 3000-3499 3500 – 3999 >4000	 5 14 33 14 5	 2 15 22 16 21	Chi-square for linear trend (M^2) = 7.81 DF = 1 P = 0.005
Reasons for admission to NICU Grunting respiration macrosomia meconium aspiration sepsis others AS 1,2,3 AS 4,5,6		 38 20 11 4 3 36 35	

Summary: comparison of cases and controls

No bearing on whether case or a control

- HIV status, past obstetric history, number of antenatal visits, duration of referral to management at UTH
- Spontaneous or induced, augmentation, duration of labour, fetal distress, mode of delivery
- decision to delivery time for caesarean, sex of baby

LOGISTIC REGRESSION

Plausible determinants to explain reasons for term neonates becoming cases (low Apgar score) compared to controls (other reasons for admission to NICU) were explored using logistic regression to control for potential confounders. Delivery at night (after 1700hrs) and by an SRMO were independently associated for a term neonate admitted to NICU to be a case compared to a control.

Table 5: Association of factors determining whether case

Cases more likely if:

Factor	**unadjusted odds ratio (95% CI)**
Clinic referral	OR (N/A) (All 100% cases and 72% of controls were clinic referrals)
Young (<25 years)	OR= 2.67 (95% CI 1.35 to 5.27)
Unemployed	OR (N/A) (11 cases vs. 0 controls)
Primiparous	OR 2.32 (95% CI 1.19 to 4.53)
Non-cephalic	OR 3.99 (95% CI 1.09 to 18.56)
Admission time night	OR 3.82 (95% CI 1.92 7.58)
Delivered by SRMO	OR 10.4 (95% CI 3.25 to 43.04)

In order to control for various confounders, a logistic regression model was developed as presented overleaf in table 6:

Table 6: Logistic Regression Model

Logistic regression

Deviance goodness of fit chi-square =		21.53	df = 17 P = 0.204
Deviance (likelihood ratio) chi-square =		63.52	df = 7 P < 0.001

Intercept	b0 = -18.8	z = -9.48E-03	P = 0.992
Clinic referral	b1 = 17.97	z = 9.06E-03	P = 0.993
time seen night (17-8hrs)	**b2 = 1.21**	**z = 2.89**	**P = 0.004**
Breech	b3 = 1.9	z = 1.53	P = 0.126
Fetal distress	b4 = 0.88	z = 1.35	P = 0.178
Cs	b5 = -0.84	z = -0.99	P = 0.32
Midwife	b6 = 0.21	z = 0.25	P = 0.805
SRMO	**b7 = 2.6**	**z = 3.78**	**P < 0.001**

logit Y = -18.8 +17.97 Clinic referral = 1 +1.21 time seen night (17-8hrs) +1.9 Breech=1 +0.88 Fetal distress -0.84 Cs=1 +0.21 Midwife +2.6 SRMO

Logistic regression - odds ratios

Parameter	Estimate	Odds Ratio	95% CI
Constant	-18.8		
Clinic referral	17.97	63796519.08	* to *
time seen night (17-8hrs)	**1.21**	**3.34**	**1.47 to 7.58**
Breech	1.9	6.66	0.59 to 75.58
Fetal distress	0.88	2.42	0.67 to 8.72
Cs	-0.84	0.43	0.08 to 2.27
Midwife	0.21	1.23	0.24 to 6.39
SRMO	**2.6**	**13.41**	**3.49 to 51.49**

After adjusting for confounders, been seen at night and delivery by an SRMO remained as independent associations for a neonate admitted to NICU being a case (i.e. low Apgar score)

DISCUSSION

During the six-month study period, 147 babies were recruited and enrolled in the study of which 71 were admitted with birth asphyxia and 76 for other diagnosis. The targeted figure of 160 was not achieved because the short fall was under age mothers below the age of consent. The maternal age ranged between 18 and 41 years with an average of age of 30years.The majority of the mothers whose babies had a low Apgar score were aged between 25 and 29 years while those admitted for other reasons varied between 30 and 34 years. There were 42 (59%) male babies and 29 (41%) female babies admitted with asphyxia with an average weight of 3233 grams and the majority 33(71%) of the asphyxiated babies had a birth weight ranging between 3000 grams and 3499grams.The minimum and the maximum weights recorded were 2204 grams and 4275grams respectively.36(51%) of the babies had severe asphyxia (1-3) and 35 (49%) had mild birth asphyxia at 1min.Most 0f the babies were noted to have improved their Apgar score at 5 min with only suctioning ,oxygenation or without any vigorous resuscitation at all. Only two (3%) of the asphyxiated babies required resuscitation with intubation and four (6%) required vigorous resuscitation with drugs (adrenaline and dextrose).The most common reason for admission other birth asphyxia was reported as grunting respiration 38 (50%) followed by macrosomia 20(26%), meconium aspiration 11 (14%) and sepsis 4 (5%).

The study shows that the majority (99%) of the mothers had at least some form of formal education from primary to tertiary education. Only one (1%) of the mothers did not have any formal education. Primary and secondary education accounted for the largest proportions 27 (38%) and 35 (49%) respectively. The majority of the mothers 41(58%) were from low social economic status residences. Furthermore most of the mothers were housewives 41(58%), single and unemployed 11 (15%), and school girls 11(15%).These factors are often associated with low social economic status, however it is not possible from this study to deduce the effect of low social economic status and birth asphyxia. The study also illustrated a greater proportion of mothers 48(68%) were primiparas. Primigravida is a known antepartum risk factor for unfavorable fetal outcome including low Apgar score (ICCDR, B publication 2009), (Siwila et al,2009).The high prevalence of primiparas in this study is not strange as this has been identified as a risk factor for birth asphyxia in many studies done elsewhere (Kinoti,1993). For example studies done in Zimbabwe and Malawi

on risk factors for perinatal loss found the prevalence of primiparity in women delivering newborns with low Apgar score to be 60% and 79% respectively (Mbwenza, 2000). Most of the deliveries occurred between 37-39 gestation weeks, 52 (73%), followed by 19 (27%) at 40 weeks or more. The babies admitted for other reasons also showed the majority of the mothers to have delivered between 37-39weeks.

The role of antenatal care in reducing mortality and morbidity is well known and its importance in terms of quality rather than frequency cannot be overemphasized .In this study 29 (41%) of the mothers attended 2-3 visits and 41(58%) had four or more antenatal visits. Only one (1%) of the mothers had one antenatal visit. A study conducted in Zimbabwe by Nacho on mortality and immediate morbidity in term babies with low Apgar score found that the absence of antenatal care was not a significant risk for low Apgar score (Nacho et al, 1990). 73% (52) of the mothers had their routine haemoglobin estimation done while 27% (19) had no haemoglobin estimation done. Anaemic mothers with haemoglobin of less than 11g/dl (WHO) was found in 3% (n=2). 97% (69) of the mothers knew their HIV serostatus and only 3% did not know their status. Of those who knew their status, 15% (n=11) were reactive for HIV. Though viral infections have been associated with low Apgar score in some studies (Badawi et al,1998), this study does not bring out this relationship; however, the 15% is a big fraction and this entail many challenges in mounting interventions to curb the mother to child transmission of HIV. All of the mothers whose babies were admitted for asphyxia were clinic referrals and the commonest reason for referral was prolonged labour 20 (28%), followed by eclampsia 9 (13%), PIH 8 (11%), malpresentation 8 (11%) and CPD 7 (10%) in that order. Other reasons for referrals in order of frequency were big baby, PROM, Pre-eclampsia, Transverse lie, Previous caesarian section, IUFD, oedematous cervix and Postdates. Most (n=31, 27%) of the referred patients were seen at UTH between 2 and 5 hours after referral. Only three (3%) were seen within one hour after referral and 11 (9%) were seen more than 5 hours after referral. The majority 49 (69%) of the referred cases were seen between 17-18hours and 22 (31%) were seen between 08-17 hours. Among the known risk factors for birth asphyxia with which the mothers were admitted at UTH malpresentation topped the list and accounted for 10 (14%) followed by pre-eclampsia and eclampsia at nine (13%) each, cephalopelvic disproportion at five (7%) and fetal distress and PROM accounted for one (1%) each. Surprisingly the greatest

proportion 34 (48%) was among those who had a diagnosis of normal labour on admission to UTH. Hypertensive disorders, fetal distress, malpresentation and obstructed labour have been associated as risk factors for birth asphyxia in many studies.

Although induction of labour is often cited as one of the risk factor for birth asphyxia, however in this study, only four (6%) had their labour induced while the largest proportion 67 (94%) had spontaneous labour. Augmentation of labour on the hand accounted for a slightly higher percentage compared to induction of labor's 17 (25%) mothers whose labour was augmented ended up delivering babies with birth asphyxia. Analgesia in form of pethidine was given to nine (13%) while the majority 62 (87%) did not receive pethidine.

The majority of the babies that developed asphyxia were in cephalic presentation 61 (86%) and malpresentation (breech and transverse) accounted for 7 % (5) each. Fetal malpresentation was also associated with birth asphyxia in an epidemiological study of perinatal loss in rural Maharashtra (India), (Dara and Daga, 1983).

The largest proportion of the mothers 48 (68%) delivered between 10 and 20 hours, followed by 10 (14%) who delivered after 20 hours of labour onset and 9 (13%) delivered within 10 hours of the onset of labour. This finding in the study carried out in rural Maharashtra in India in which prolonged labour was also found to be highly associated with birth asphyxia. An appropriate response and interventions is needed to help mitigate the effects of prolonged labour. There was an equal number of mother that delivered by spontaneous vaginal delivery and caesarian section 33 (71%) in the asphyxiated babies and five (7%) had instrumental delivery. However, the babies that were admitted for other reasons the majority 42 (55%) delivered by the spontaneous vaginal mode; while 34 (45%) and four (5%) were delivered by caeserian section and instrumental deliveries respectively. The commonest indication for caeserian section in the asphyxiated group was cephalopelvic disproportion 10 (58%) followed by fetal distress 6 (18%) ,transverse lie 4 (12%),and eclampsia 3 (9%).The time interval between the decision for caeserian section and the actual time the caesarian section was performed varied from less than 1 hour to more than 3 hours. Only two (6%) had the operation done within one hour of decision-making, the majority 31 (94%) had the caesarian section performed after over an hour of decision-making. A rapid response in such emergencies may help mitigate these consequences.

Overall the study revealed that most of the deliveries were conducted by midwives 28(39%), followed by senior resident medical officers 26(36%) and registrars at 17(24%). In this particular study, none of the mothers were delivered by the senior registrar or the consultants.

Of the babies that developed birth asphyxia 30 (42%) had clear liquor, 35 (49%) had old meconium stained liquor and six (8%) had fresh meconium stained liquor. There were more babies admitted for other reasons with either clear liquor 52 (68%) or old meconium stained liquor 17 (22%).Fresh meconium in this group with no asphyxia accounted for 7 (9%). Overall of the 71 babies admitted with birth asphyxia 11 (16%) were diagnosed with fetal distress (FHR and Fresh meconium stained liquor) while 60 (84%) were considered to have no fetal distress but ended up with asphyxia.

STUDY CONSTRAINTS/LIMITATIONS

The results of this study cannot be generalized as this was a Hospital based which is the main referral centre in the district and most of the cases seen already have complications. It is therefore anticipated that the incidence of birth asphyxia will be high, as most mothers delivering at this institution already have known risk factors. The mothers below the consent age were excluded and this reduced the targeted sample size. The entry criteria for the cases were based on the gestational age and Apgar score .The Apgar score is a very subjective measurement with inter and intra observer variations. The gestational age based on LNMP is equally subjective as about 30-40 % of expecting mothers cannot remember the exact date of their last normal menstrual period (LNMP).This implies that some of the mothers studied could either have been excluded or included.

CONCLUSIONS

This study has shown that birth asphyxia is associated mostly with the antepartum and intrapartum risk factors. Prolonged labour was the commonest among the known obstetric risk factors for birth asphyxia and accounted for 28% of the cases. Hypertensives disorders in pregnancy, malpresentation and cephalopelvic disproportion were among the leading risk factors for birth asphyxia illustrated in this study. Prolonged labour is an essentially an avoidable risk factor for birth asphyxia and therefore appropriate interventions need to be scaled up. All of the asphyxiated babies had their mothers referred from the clinic .The mode of delivery did not seem to have any significant impact as a risk of birth asphyxia. The majority of the women 58% had at least four or more antenatal visit as recommended in focused antenatal care. There is need to review the quality rather than frequency of antenatal care. Thirty six percent of the mothers had only 2-3 antenatal visits; hence, there is also need to scale up on the numbers of antenatal visit in this group.

RECOMMENDATIONS

The following recommendations are suggested:

- Evaluate the referral system
- Reduce the problem of prolonged labour with improved monitoring of labour with partograph
- Evaluate the quality offered in Antenatal care
- Close monitoring of mothers on oxytoxic augmentation

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APPENDIX
DATA COLLECTION TOOL

Determinants of Admission for Birth Asphyxia Among Term Babies Admitted to the Neonatal Intensive Care Unit at the University Teaching Hospital.

File no…….

ANTEPARTUM:

1) Demographic features

Age……..

Sex……..

Occupation……..

Address……..

Education status: none/primary/secondary/tertiary

Parity……

Gestational age…….

Body weight……

2) Antenatal risk factors

Hb…….

No antenatal visits……..

HIV Serostus: NR/R/unknown

3) Past obstetric history

SVD/C-section…….

Instrumental delivery: yes/ no-forceps/ ventouse

Induction of labour: yes/ no

4) Medical disorders

Chronic HTN: yes/ no

Preeclampsia: yes/ no

Eclampsia: yes/ no

PIH: yes/ no

Diabetes mellitus: yes/ no

Cardiac disease: yes/ no

Anaemia: yes/ no

Maternal pyrexia; yes/ no

5) Intrapartum
Self-referral: yes/ no
UTH Booked: yes/ no
Clinical referral: yes/ no
Reason for referral……
Diagnosis at UTH……..
Referral time…….
Time seen at UTH……
Name of referring Clinic…….

6) Conduct of labour
Spontaneous labour/induction of labour
If IOL, indication…….; mode of induction……..
Duration of first stage labour……..
Duration of second stage……..
Augmentation of labour: yes/no……. dose of Oxytocin
PROM: yes/no……. Duration of PROM……

Fetal presentation: cephalic/ breech/ others
Fetal condition in labour: Good-yes/ no
Type of liquor: clear/meconium stained
Meconium: old/ fresh
Fetal distress: yes/ no

Analgesia: yes/no; type……..
Interval between administration of analgesia and Delivery……hrs

7) Intrapartum Accidents: yes/ no
Abruption placenta
Placenta praevia
Cord prolapsed
Ruptured uterus

8) Mode of delivery
SVD: yes/no
Instrumental: yes/ no type……. indications……..
C/section: yes/ no; indication……..
Time interval between decision for C/section and delivery……..

Staff conducting labour: Midwife, JRMO, SRMO, Registrar, Senior Registrar, and Consultant.

Home delivery: yes/ no
Clinic delivery: yes/ no
UTH delivery: yes/ no

9) Outcome
Baby weight……kg
Sex M/F
DOB……..
TOB……
Apgar score at 1min…….at 5min……..

10) Resuscitation measures
Suction
Oxy gen
Intubation
Oxygen and suction
Oxygen, suction and intubation
Drugs: yes no; specify……..

11) Admission to NICU: yes/ no
Diagnosis for admission…..
1……
2……
3……

12) Time of Arrival at NICU……..