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A STUDY ON THE INCIDENCE AND FACTORS ASSOCIATED
WITH BIRTH ASPHYXIA AT THE UNIVERSITY TEACHING
HOSPITAL IN LUSAKA, ZAMBIA.

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DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENT AND FOR THE DEGREE OF MASTER
OF MEDICINE IN OBSTETRICS AND GYNAECOLOGY



DEDICATION

This work is dedicated to my dear wife, Mutinta and our children Msenya and Luumuno who are the source of my inspiration.

ACKNOWLEDGEMENTS

My sincere gratitude goes to the following:

Delia Banda and Evenly Mbewe for tirelessly collecting data

All labour ward staff for their cooperation and assistance during data collection

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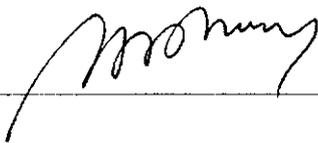
Prof. Siziya, who assisted with statistical analysis

Dr C. Kaseba and Dr T.Kafula for their constant supervision and encouragement

STATEMENT

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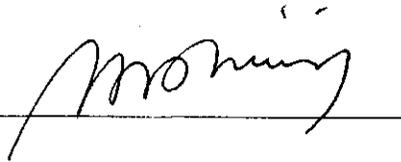
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DECLARATION

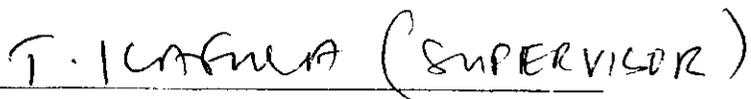
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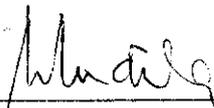
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APPROVAL

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ABSTRACT

Birth asphyxia is a significant contributor to newborn morbidity and mortality as well as long term neurological deficits. It has remained a common problem in the developing world. Labour related problems for example, prolonged labour, intrapartum accidents, abnormal fetal presentation, fetal distress and primiparity continue to be important causes of asphyxia. This was a cross-sectional study conducted during a six month period from 1st February to 31st July 2001 to establish the incidence of birth asphyxia defined as an apgar score ≤ 6 at 5 minutes at UTH and to document maternal, intrapartum and fetal factors associated with birth asphyxia and case fatality rate in the first week of life.

During the study period, there were 4529 singleton live births weighing more than 1500g. Of these infants, 229 were born with an apgar score ≤ 6 at 5 min giving an incidence of 50/ 1000 live births. When only term infants defined by birth weight of ≥ 2500 g the incidence was 43 / 1000. Most mothers (66.8%) had a satisfactory antenatal attendance with an average of 6 visits (range 0-13). Of the asphyxiated babies, 29.4% were born to teenager mothers (15-19yrs) and 55% of the mothers were primigravidas. Labour was prolonged in 46% of the cases. Fetal distress was diagnosed in 30% of the cases. Meconium staining of liquor was present in 23% of the cases and it was significantly associated with fetal distress (OR= 43.7, 95% CI= 13.8,14.7, $p < 0.001$).

An intra-partum accident occurred in 12% of the cases. The caesarean section rate of 35% among the cases was higher than that of the general delivering population at

12.5% and the commonest indication was fetal distress. The case fatality rate of neonates born with a low apgar score of 6 or less at 5 minutes at the end of the first week was 45% and 9.2% of these newborns died within the first 24hours. An apgar score ≤ 3 at 5 min was significantly associated with death (OR=22, 95% CI 4.86,13.8, $p<0.001$).

Male neonates were 1.47 times more likely to die than their female counterparts (OR 1.87, 95% CI 1.02-3.41, $p<0.04$).

The study has shown that birth asphyxia is a common problem at UTH with a high case fatality rate. Improved obstetrical care, especially intra-partum monitoring and appropriate resuscitation techniques will assist in reducing birth asphyxia and it's associated morbidity and mortality.

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ABBREVIATIONS

ABD	Assisted breech delivery
APH	Ante-partum haemorrhage
C/S	Caesarean section
CTG	Cardiotocography
FD	Fetal distress
Hb	Haemoglobin
HIE	Hypoxic- ischaemic encephalopathy
NICU	Neonatal Intensive Care Unit
NO	Number
PE	Pre-eclampsia
PMR	Perinatal Mortality Rate
PROM	Pre-labour rupture of membranes
SVD	Spontaneous vaginal delivery
UTH	University Teaching Hospital

INTRODUCTION

Background Information

Birth asphyxia is a significant contributor to the newborn morbidity and mortality as well as long term neurological deficit (1,2). It is a significant cause of neuro-developmental handicaps in full term babies and has remained a common problem in the developing world with high mortality (1). Seven million perinatal death occur each year mostly in the developing world and nearly four million newborns suffer moderate to severe asphyxia with at least eight hundred thousand dying (3).

The incidence of Birth asphyxia varies widely because of different definitions used. However, highest incidence rates are found in developing countries like Nigeria 26/1000, Libya 28/1000, and the lowest incidences are found in developed countries which range between 2.5 to 9.0/1000(1). In Central Africa, one study found the incidence to be 22% (4) In Zambia, the incidence of Birth asphyxia has not been established, however the neonatal mortality rate in 1996 was 35.4/1000 (5).

Labour related problems for example; prolonged labour, abnormal presentation, intrapartum accidents and fetal distress continue to be important causes of birth asphyxia in the developing world (4). Primiparity and hypertensive disorders of pregnancy have been identified as obstetric risk factors for birth asphyxia. The judicious use of the partogram with efficient referral facilities would go a long way in reducing perinatal morbidity and mortality (6). Several studies done in Africa suggest that half of the causes of birth asphyxia can be prevented (4,47,48).

Information regarding birth asphyxia at UTH is scanty. However, anecdotal observations and information obtained at a combined perinatal mortality meeting between the department of Obstetrics and Gynaecology and Paediatrics held in 1998 appeared to suggest that the incidence of birth asphyxia was high with term babies contributing a good proportion of it.

STATEMENT OF THE PROBLEM

It has been observed that birth asphyxia is a significant contributor to perinatal morbidity and mortality in Africa. A review of causes of admission to the neonatal intensive care unit for the year 1999 revealed that 3499 (29.3%) newborns born at UTH were admitted to the facility and birth asphyxia was the second highest cause after prematurity and accounted for 28%. Further analysis revealed that 18% of the asphyxiated neonates that weighed more than 2000g or above died during their admission.

JUSTIFICATION OF THE STUDY

Although asphyxia has been identified as a significant contributor to perinatal morbidity and mortality, there is no readily available data on birth asphyxia and its outcome at the University Teaching Hospital in Lusaka. Therefore, there is need to establish information on birth asphyxia and its contribution to perinatal mortality and morbidity of the newborn

In addition it will be important to identify contributing factors and preventable causes of asphyxia at U.T.H. Furthermore, studies have shown that birth asphyxia can be prevented by improved antenatal and intra-partum care as well as adequate and appropriate resuscitation.

It is hoped that the provision of such data on this very important subject may alert clinicians to the problem and will in turn strive to prevent birth asphyxia and thereby contribute to the reduction of perinatal mortality and morbidity in the short term and physical and mental disability in the long term. Furthermore, by avoiding birth asphyxia the financial burden resulting from care of affected neonates on the already cash strapped health service will be reduced. It is with this purpose that this study was conducted.

LITERATURE REVIEW

Definition of asphyxia

There is no single or widely accepted definition of birth asphyxia (7). Definitions used in several studies include evidence of intrapartum foetal distress (diagnosed on the basis of abnormalities of the foetal heart rate, hypoxia, acidosis or passage of meconium), failure to initiate or sustain respiration and circulation after birth (poor Apgar score) and abnormal neurological or behavioural condition of the infant (1,8,14).

Patho-physiology of asphyxia

There are a number of principle mechanisms that have been described by which asphyxia of the human infant occurs during labour, delivery and immediate postpartum period and these include the following:

- i. Interruption of umbilical circulation (cord prolapse)
- ii. Altered placenta gas exchange (placenta abruption)
- iii. Inadequate perfusion of maternal side of placenta (pre-eclampsia, hypertension)
- iv. Impaired maternal oxygenation (anaemia, cardio pulmonary disease)
- iv. Failure of the neonatal to accomplish lung inflation and successful transition from fetal to neonatal cardio pulmonary circulation (9).

A healthy foetus is equipped with a range of adaptive strategies to reduce oxygen consumption and protect vital organs during an insult. Initially there is selective vasoconstriction of certain organs and vasodilation of others, which result in increased

blood flow to the brain heart and adrenal glands and reduced blood flow to other organs (10,11). When asphyxia becomes severe the protective mechanisms are overwhelmed and vital organs oxygen consumption cannot be maintained (12). This represents a point of decompensation of the protective physiological mechanisms that had lessened the impact of birth asphyxia (13). During asphyxia, three types of brain damaging mechanism occur: acidosis, accumulation of cytotoxic amino acids and generation of oxygen derived free radicals together with calcium intoxication (14). In term asphyxiated neonates the accumulation of these products of anaerobic metabolism may lead to neuronal damage, oedema and clinical signs of encephalopathy (14).

The well recognised organ dysfunction associated with asphyxia during labour in the neonatal period include renal failure, respiratory distress, hepatic damage necrotizing enterocolitis, intracranial haemorrhage, coagulopathy, heart failure, evidence of acute encephalopathy (seizure, apnea), abnormal neuromuscular tone and death. Long term neurological deficit include cerebral palsy and micro-encephaly (15,16).

TOOLS USED TO ASSESS ASPHYXIA

The assessment of foetal and neonatal asphyxia currently depends on Apgar score at 1 and 5 minutes or later, acid base status as shown by foetal scalp pH, umbilical venous or arterial blood gases, abnormalities of foetal heart rate, passage of meconium and early neonatal seizures(16). The combination of these factors rather than singly help to make the diagnosis of asphyxia more accurate (7).

Apgar score

Apgar score assigned at 1 and 5 minutes, is the most widely used indicator of fetal condition at birth and has been used to define asphyxia and also serves as reference for other diagnostic tests and attempt to prognosticate outcome (17,18). It was introduced in 1958 by Virgin Apgar, an anesthesiologist, as a scoring system of assessment of newborn at delivery and how smooth the transition from fetal to newborn life occurred (19).

Although the Apgar score has been used as a criteria in assessment of asphyxia in many studies, it is thought to be non specific because the correlation between Apgar score and long term outcome is poor (3). It can be affected by prematurity, maternal sedation and disorders affecting the neuro-mascular system of the newborn. Furthermore, improper scoring and inconsistency among observers affect the reliability of Apgar scores (20). However persistent low Apgar scores have been shown to bear a fair relationship to long term outcome (21).

Marlow noted that the criticism against Apgar score would have more weight if other measures of fetal compromise had any closer relationship with outcome (22).

pH

Low pH has been considered the best widely available measure for identification of asphyxia during labour. however, the relationship of low pH to neurological symptomatology has not been impressive. Most acidotic babies do not become neurologically symptomatic and those that are symptomatic are not markedly acidotic (23,24).

Most studies consider an umbilical arterial pH less than 7.1 to indicate severe asphyxia and pH less than 7.2 to indicate some degree of asphyxia although there is a variation (14). Combining Apgar score and arterial pH suggest that severe depression of Apgar score of less than or equal to 3 at 5 minutes and pH less than or equal to 7.0 is needed before significant asphyxia can be confidently diagnosed (17).

Hypo-ischaemic encephalopathy (HIE)

HIE refers to a collection of abnormal neurological signs which occur in a temporal sequence over a period of time and has been subdivided into mild, moderate and severe categories (7). Moderate and severe HIE confer an increased risk of death or serious neurological handicap (25). Whilst appearing to be a reliable indicator of future handicap, encephalopathy doesn't appear to be specifically related to hypoxia only (14). Early neonatal seizures which are considered to be good markers of intrapartum asphyxia can be caused by other conditions like infection, metabolic and cerebral abnormalities besides asphyxia(26,27).

Fetal heart rate

Cardiotocography (CTG) is the gold standard for fetal surveillance during labour, however its limitations lie in the difficulties associated with interpretation (28). It has been commonly stated in the past that fetal heart rate monitoring is extremely accurate in diagnosing fetal vigour when pattern is normal and that it is poor for determining depression when pattern is abnormal (14). Although CTG is reasonably sensitive for acidemia or low Apgar score, it has a low specificity and therefore its positive

predictive value is low (29). However marked fetal bradycardia (below 60 beats per minute) has been associated with increased risk of cerebral palsy (30).

Meconium in amniotic fluid

Meconium staining of liquor is seen in up to 18% of all labours (31). Its passage in utero is generally considered to be a sign of fetal distress and it is known to carry a significant risk of neonatal death when aspirated (32,33). Thick meconium recognised at onset of labour carries the worst prognosis (34). When meconium in amniotic fluid is considered in isolation it has not been associated with increased risk of cerebral palsy. However, when considered with low Apgar score, an increased risk is demonstrable (35).

BURDEN OF ASPHYXIA AND RISK FACTORS

Birth asphyxia is said to contribute 3-13% of cerebral palsy in developed countries (36). In one study done in the USA, the incidence of Interpartum asphyxia was 2.3% and a significant proportion of intrapartum asphyxia occurred in pregnancies with risk factors. Some of the antenatal risk factors were, previous still or neonatal death, maternal medical complications, fetal complications like post dates and preterm delivery and intra-partum complications such as prolonged labour or foetal malpresentation (36).

In a Western Australian case control study of antepartum risk factors for newborn encephalopathy, the prevalence of severe or moderate encephalopathy in term babies was 3.18/1000 with a neonatal case fatality of 9.1% and the risk increased with

advanced maternal age and parity, unemployment and housewives (37). Other risk factors before conception were family history of seizures or other neurological diseases and during pregnancy are pre-eclampsia, moderate or severe bleeding or viral infection. Some of the factors suggest that cerebral palsy and neonatal seizures may be as a result of genetic factors or early foetal development factors (37). In another similar study, intrapartum risk factors were persistent occipital position, maternal pyrexia and an acute intrapartum event (38).

An epidemiological study of perinatal loss in rural Maharashtra, India, found that low birth weight and asphyxia were the most important determinants of perinatal loss. Acute asphyxia was commonly associated with hypertensive disorders pregnancy, abnormal presentation and prolonged labour (39). Another study that examined the reasons for admission, causes of death and cost of admission to a tertiary neonatal unit in India noted that the main causes of death were asphyxia, infection, cord injury, respiratory disorders and congenital abnormalities (40). In a study done in 1983 at Kenyatta National Hospital newborn unit, it was noted that the major causes of death were prematurity, respiratory distress, perinatal asphyxia and infection (41). A retrospective study conducted in 1983 at Eldoret district hospital in Kenya, concluded that intrapartum asphyxia was the commonest probable cause of death and it accounted for 45.8% of all stillbirth (42). In Uganda, a study done over a three-year period on birth trauma among live born infants in Mulango hospital, hypoxaemic brain injury resulting from birth asphyxia was by far the commonest form of birth trauma and the main cause of death (43). A retrospective study in South Africa designed to examine 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, pre-labour rupture of membranes (PROM) and meconium staining of liquor associated with other signs of foetal distress were the main risk factors that resulted into significant morbidity and mortality (44).

In Nigeria, a prospective study of neonatal death at Oguni State University Teaching Hospital found the PMR to be 50/1000 and the leading causes of death were birth asphyxia, infection and respiratory distress syndrome. In full term babies, severe birth asphyxia resulted from prolonged and obstructed labour, post term delivery and intrapartum accidents (45).

In a multi- centre study on birth asphyxia in East and Central Africa, obstetric factors that contributed to asphyxia of newborns included prolonged labour, abnormal presentation intrapartum accidents and hypertensive disorders of pregnancy (4).

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 (46).

IS BIRTH ASPHYXIA AVOIDABLE?

Where as recent literature from developed countries like USA suggest that birth asphyxia is unavoidable and unrelated to intrapartum management, some studies done in Africa suggest the contrary (47).

In Zimbabwe a study that audited perinatal mortality concluded that the commonest single cause of death was perinatal asphyxia and an avoidable factor was detectable in 76% of cases (48). A Nairobi birth survey showed that 50% of perinatal morbidity and mortality is preventable (49).

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 transfer of complicated cases to a tertiary care hospital would help to reduce this number (47).

A study that evaluated the role of the identification, cause and avoidable factor (ICA) solution method of perinatal audit in reducing perinatal mortality conducted at Livingston Hospital in South Africa found that 50% of perinatal death was avoidable and major primary obstetric causes of perinatal loss amenable to intervention were intra-partum asphyxia, trauma and infection (50).

It is estimated that about 6% of all newborns delivered in the United States require some type of neonatal resuscitation (51,52). Appropriate and adequate neonatal resuscitation can prevent morbidity and mortality from birth asphyxia such that even severely compromised infants may survive with less sequelae (53,54).

By identifying avoidable risk factors such as those related to management of labour and some administrative problems, the incidence of birth asphyxia and therefore the perinatal morbidity and mortality rate of newborn can be reduced (55).

OBJECTIVES

General objectives

To determine the incidence and factors contributing to birth asphyxia of newborns at University Teaching Hospital, Lusaka.

Specific Objectives

1. To determine the incidence of birth asphyxia at UTH.
2. To investigate demographic characteristics of mothers whose babies are asphyxiated at birth.
3. To identify antepartum and intrapartum factors that contributor to with birth asphyxia.
4. To establish the case fatality rate of asphyxiated babies in first week of life.

METHODOLOGY

Study Type

This was a cross-section study over a period of six months from 1st February to 31st July 2001.

Study Setting

The study was conducted at UTH Lusaka in the Labour Ward of the department of Obstetrics and Gynaecology and neonatal Intensive Care Unit (NICU).

The University Teaching Hospital is the largest tertiary and only specialist hospital in Zambia and it is located in Lusaka, the capital city of Zambia. Lusaka urban has a catchment population of 1,6 million. About 10,000 deliveries are conducted at UTH annually while another 36,000 occur at other clinics which provide maternity services in Lusaka.

Study Population: babies born with a low apgar score of 6 or less at 5 minutes and their mothers who delivered at UTH.

Sample size and selection

The study aimed to recruit 370 babies and their mothers who deliver at labour ward, UTH.

Inclusion criteria: a) singleton babies with a birth weight of 1500g or more

b) newborns with an apgar score of 6 or less at 5 minutes.

Exclusion criteria: a) fresh still born, macerated still born,

b) babies who weighed less than 1500g

c) newborns with an apgar score of more than 6 at 5 minutes

d) multiple pregnancies

Sample size

The sample size has been calculated at 95% confidence using the following formulas:

$$n = z^2 pq / d^2 \quad n_f = n / 1 + n / N$$

where t = confidence interval

p = assumed proportion of asphyxia

q = variability

n = estimated sample size

n_f = final sample size

N = target population

d = amount of tolerable error

z = the standard normal deviate, usually set at 1.96

$$n = (1.96)^2 (50) (50) / 5^2 = 384$$

$$n_f = 384 / 1 + (384 / 10,000) = 384 / 1,0384 = \underline{\underline{370}}$$

Data collection

Data was collected on structured forms using trained research assistants. Each morning during the study period the asphyxiated babies as determined by apgar score that meet the entry criteria were sought and once identified information regarding conduct of labour was recorded and their mothers were followed up in postnatal wards and their medical records were reviewed and where the information was vague, the mother was asked to clarify. Babies admitted to the neonatal intensive care unit (NICU) were followed up to assess outcome in terms of fatality at day 1 and 7.

Maternal data collected included: age, parity, gravidity, occupation, education status, antenatal visits and antepartum medical disorders, past obstetric performance, and gestation age at delivery.

Intrapartum information regarding the conduct of labour was obtained by reviewing the case records after identification of babies. Data collected included duration of labour, presenting part, prom > 24hrs, meconium staining of liquor and grading, fetal condition (i.e. foetal distress or not), intrapartum accident and mode of delivery.

Neonatal details obtained included: sex, birth weight, apgar score at one and five min and mortality at day 1 and 7.

Data analysis

Data was analysed using EPI – INFO version 6.04 statistical software by looking at frequencies as well as tests for both numerical and categorical variables. Where comparisons were performed Chi square and Odds ratio were utilised (with 95% confidence interval) with significance set at 5%.

Ethical consideration

Permission to conduct the study was sought from the UNZA research and ethical committee and the Head of Department of Obstetrics and Gynaecology. Consent was obtained from mothers who participated in the study.

Working definitions

Asphyxia	an apgar score ≤ 6 at 5min
Fetal distress	diagnosis made on basis of abnormal foetal heart rate (bradycardia of less than 100 beats per minute)
Low birth weight	less than 2500g
Preterm	less than 37 completed weeks
Term	37 completed weeks
Active phase of labour	cervical dilatation more than 3 cm
Prolonged labour	a) first stage: primagravidas > 12 hrs of active phase Multi-gravida > 8 hrs of active phase b) second stage : > 1 hr regardless of parity.
Grand multi-parity	Delivered more than four times

RESULTS

Incidence

During the six month study period from 1st February to 31st July 2001, 4529 singleton live births weighing more than or equal to 1500g were born at the University Teaching Hospital, Lusaka. 229 newborn infants had an apgar score of less than or equal to 6 at five minutes giving the incidence of birth asphyxia of 50/1000 live births. When only term newborns defined by birth weight of 2500g or more were considered, the incidence of birth asphyxia was 43/1000 live births. 29 (12%) newborns had severe asphyxia (apgar score 0-3) while 200 (87.2 %) babies had moderate asphyxia (apgar score 4-6) at five minutes. The subsequent results presented relate to the 229 cases of low apgar score and their mothers.

Maternal age

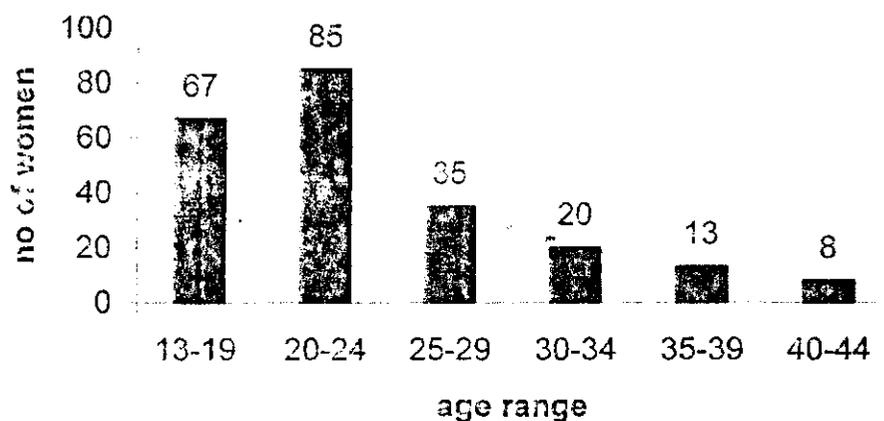
The age distribution of the 229 mothers who had infants with asphyxia ranged from 15 to 44yrs with a mean age of 23.7yrs. The age groups were stratified as follows:

<19 years, 20-24, 25-29, 30-34, 35-39 and >40 years. This is shown in table 1 and figure 1. The age of one mother was not known. The highest number of cases occurred in the 20-24 years age group which was represented by 37.3%. There were 67 (29.4%) teenage mothers and 21 (9.2%) mothers were aged 35 and above.

Table 1: Maternal age

Age	Freq	Percent
13-19	67	29.4
20-24	85	37.3
25-29	35	15.4
30-34	20	8.8
35-39	13	5.7
40-44	8	3.5
Total	228	100.0

Figure 1: Maternal Age (n =228)



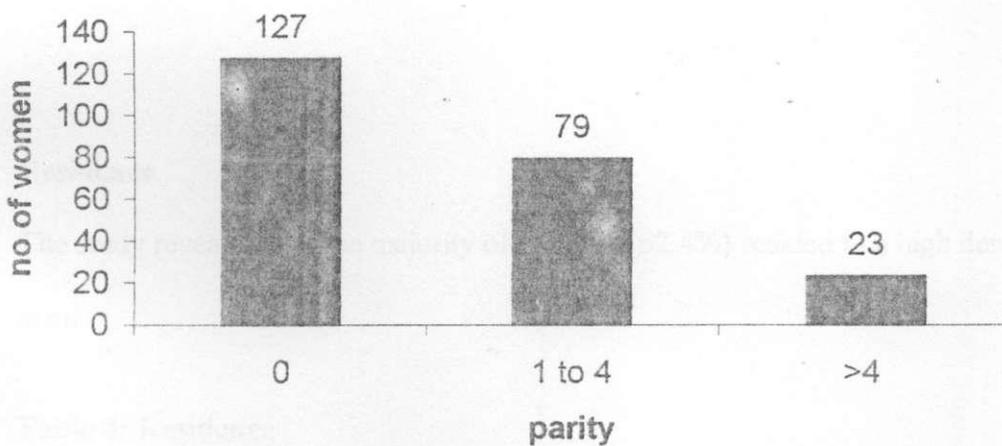
Parity

The parity of the mothers ranged from 0-9 with a median 0 ($Q_1, Q_3 = 0,2$) 1.2. Of the 229 mothers, 127 (55%) were primiparous and 23(10%) were grand multiparous.

Table2: Parity

Parity	Freq	Percent
0	127	55.5
1-4	79	34.5
> 4	23	10.0
Total	229	100.0

Figure 2: Parity (n =229)



Sixty-one teenage mothers were in their first pregnancy while 6 had delivered before. Thirteen grand multiparous women were aged 35 and above.

Education status

Of the 229 mothers, the majority of women 144(63.2%) attended primary school, 20 (8.8%) attained tertiary education while 38 (16%) had not gone to school at all.

Table3: Education status

Education attained	Freq	Percent
None	39	16.7
Primary	144	63.2
Secondary	26	11.6
Tertiary	20	8.8
Total	229	100.0

Residence

The study revealed that the majority of women (62.4%) resided in a high density area.

Table 4: Residence

Residential area	Freq	Percent
Low density	27	11.8
Medium	59	25.8
High	143	62.5
Total	229	100.0

Occupation

The majority of the women (78%) were housewives, 11% were self employed, 9% were in gainful employment while 2% were at school.

Table 5: Occupation

Occupation	Freq	Percent
Housewife	178	78
Employed	20	9
Self employed	26	11
School	5	2
Total	229	100

Figure 3: Occupation of women (n =229)



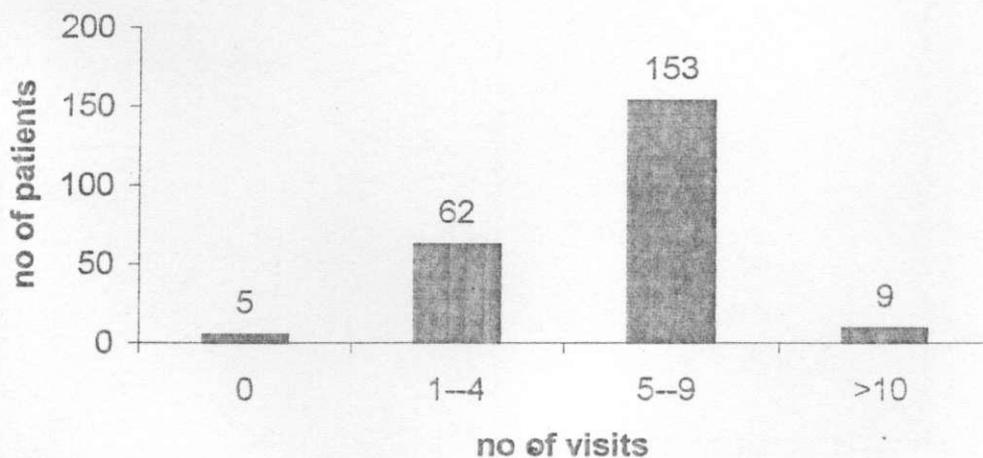
Antenatal attendance

Table 6 shows the antenatal attendance by the mothers. The number of antenatal visits ranged from 0 to 13 with a median of 6 ($Q_1, Q_3 = 4, 7$).

Table 6: number of antenatal visits

Number of visits	Freq	Percent
0	5	2.2
1-4	62	27.1
5-9	153	66.8
≥ 10	9	3.9
Total	229	100.0

Figure 4: Antenatal attendance (n =229)



The majority of the mothers (71%) had more than 4 antenatal visits, only 2% did not attend any antenatal. Forty (17%) of the mothers had a medical disorder considered to be a risk factor for asphyxia. The prevalence of hypertensive disorder was 11% and three mothers developed eclampsia, one had a cardiac disease, two mothers had sickle cell disease and a further two mothers had diabetes mellitus. Regarding their previous obstetric history at booking, fourteen mothers had previous c/s, three had a fresh stillbirth, ten had miscarriages and one mother gave a history of delivering a macerated stillborn.

The majority of the mothers (82%) did not have any antenatal risk factor for asphyxia. Regarding the antenatal course, of 121 (52%) mothers who had hemoglobin done, the incidence of anaemia ($Hb < 10g$) was 63 (52%). VDRL was performed in 183 (79%) patients and 9 (3.9%) had a positive result while 20.1% did not have VDRL done. Urinalysis was not consistently done.

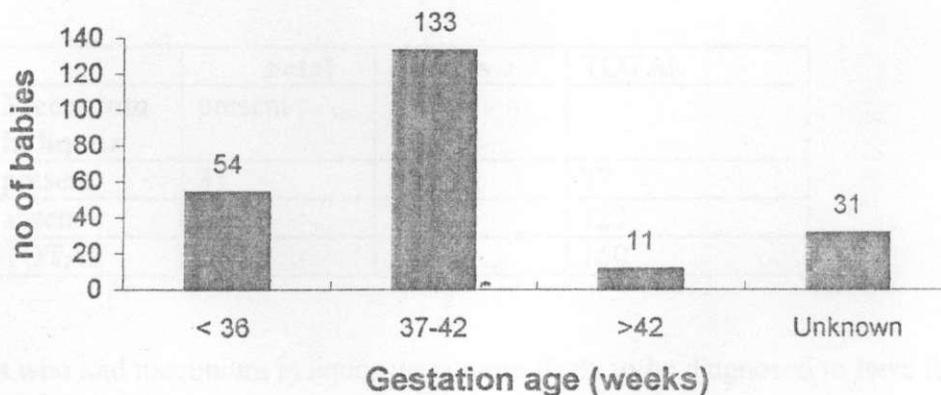
Gestational age

The gestational age at delivery of the 198 asphyxiated babies ranged from 30-44 weeks with mean age of 38.3 weeks (SD=2.6). 133 (58.1%) were term infants, 23.5% were pre-term while 4.6% were post dates. The gestational age of 31 mothers was not known.

Table7: Gestation age

Gestational age	Freq	Percent
≤36	54	23.5
37-42	133	58.1
≥43	11	4.6
Unknown	31	13.8
Total	229	100.0

Figure 5: Gestation Age (n=229)



Intrapatum

Of the 229 mothers 146 mothers were referred from the 10 midwife-led maternity clinics around Lusaka while 83 were either booked at UTH or self referrals.

In terms of demographic features, there were no significant differences between the two groups of parturient. The commonest reason for clinic referral to UTH was prolonged labour (first and second stages) 41(35.4%) followed by pre eclampsia 19 (13.2)%, APH 13(9%) and PROM 10(69%).

Onset of labour was spontaneous in 195 (9.38%) while 13 (63%) had their labour induced. Induction of labour was by misoprostol and syntocinon. The commonest indication was pre- eclampsia, followed by postdates. Pre labour rupture of membranes of more than 24 hours duration was present in 18(7.9%) of the cases. Fetal distress was diagnosed in 70(30.6%) of the cases. Meconium staining of liquor was recorded in 37 (23%) cases. The relationship between meconium staining of liquor and fetal distress is shown in table 8.

Table 8: Relationship between meconium staining of liquor and fetal distress

	Fetal distress		TOTAL
Meconium in liquor	present	absent	
present	31	6	37
absent	13	110	123
TOTAL	44	116	160

Babies who had meconium in liquor were more likely to be diagnosed to have fetal distress (OR =43.72, 95% CI = 13.8,147.2, $p < 0.0001$)

Twenty-eight (12%) of the pregnancies were complicated by an intrapartum accident. The distribution of the intrapartum accidents is illustrated in the table 9.

Table 9: Intra-partum accidents

Accident	Freq	Percent
Abruption	12	42.9
Placenta preavia	6	21.4
Cord prolapse	10	35.7
Total	28	100.0

Duration of labour

Prolonged 1st stage of labour regarded as more than 12 hours of active phase for primagravidas and more than 8 hours for parous women was present in 68 (33.7%) of 202 mothers. Forty (17.5%) of the mothers had their labour augmented. Twenty mothers had c/s performed for prolonged 1st stage. Thirty-eight (24%) mothers out of 153 who went into second stage of labour had a prolonged second stage defined as labour lasting more than one hour. Of these mothers, 7 were delivered by c/s. Instrumental deliveries were performed in 16 cases while 15 delivered spontaneously or after an episiotomy.

In the 229 cases, the distribution of known factors associated with asphyxia is shown table 10.

Table 10: Distribution of known factors

factor	Freq	Percent
Prolonged labour	106	46
Fetal distress	70	30
Prom	18	7
Meconium staining of liquor	37	25
Intrapartum accident	28	12.2
Hypertensive disorders of pregnancy	27	11.7
Breech	19	8.7
Abnormal presentation	11	4.8

Numbers do not add up to 100%. It was possible to have more than one factor.

Among babies born with low apgar score, 20 (8.8%) did not have any antenatal risk factor or an obstetric complication.

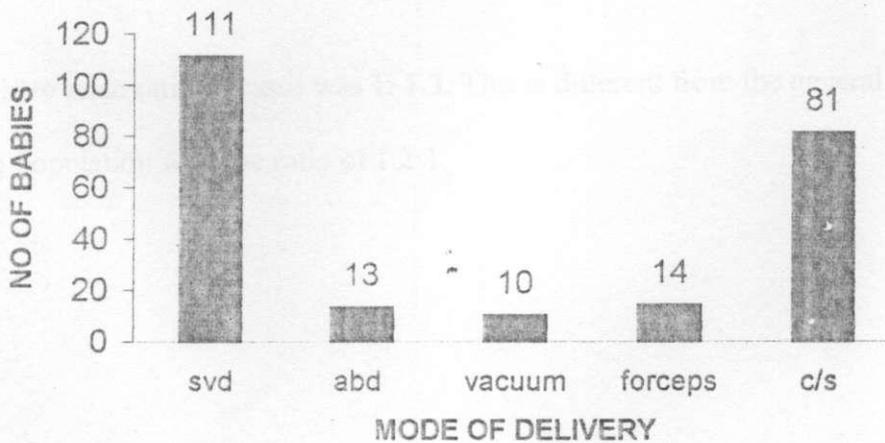
Mode of delivery

Vaginal delivery was the commonest mode at 48.4% followed by c/s. C/s rate of 35.4%. Assisted breech delivery occurred in 5.7% of the cases. The commonest indication for c/s was fetal distress (45.7%) followed by prolonged labour (both 1st and 2nd stage) at 17.2%. Instrumental deliveries i.e. forceps and vacuum were at 6.1% and 4.4% respectively.

Table11: Mode of delivery of the cases.

Mode	Freq	Percent
SVD	111	48.4
ABD	13	5.7
Vacuum	10	4.4
Forceps	14	6.1
C/s	81	35.4
Total	229	100.0

Figure7: Mode of delivery (n =229)



Birth weight and sex

The distribution of the birth weight ranged from 1500g to 5000g with a mean weight of 2854.6grams (SD =560.5). Birth was stratified within the following categories; 1500-2499 and more than or equal to 2500g.

Table 12: Distribution of birth weight

Birth weight	freq	Percent
1500-2499g	58	25.3
≥2500g	171	74.7
Total	229	100.0

The distribution of the cases by their gender is illustrated in table 13.

Table 13: Distribution of gender

Sex	Freq	Percent
Female	97	42.4
Male	132	57.6
Total	229	100.0

The female to male ratio of cases was 1: 1.3. This is different from the general delivering population with the ratio of 1.2:1

Apgar score

Neonatal assessment and evaluation was done immediately at delivery and the apgar score at 1 and 5 min was recorded in patients files and delivery register. The distribution of infants by their apgar score defined as moderate (4-6) and severe (0-3) is illustrated in table 14.

Table 14: Apgar score at one and five minutes

Apgar score	1 min	5min
0-3	90 (39.3%)	29 (12.7%)
4-6	139 (60.7%)	200 (87.3%)
total	229 (100%)	229(100%)

Resuscitation

All 229 babies received the basic resuscitation of suctioning and oxygen by ambu bag. Twenty-four (10.5%) neonates were intubated before being transferred to the neonatal intensive care unit. Naloxone was administered to 2 (0.9%) babies. Sixty-one (66%) neonates improved their one minute apgar score from severe (0-3) to moderate (4-6) at five minutes.

Feotal outcome

Of the 229 neonates delivered at UTH with low apgar score, four died before being transferred to the neonatal intensive care unit.

Of these babies 21(9.2%) died within the 1st 24hrs and 21 babies were discharged before one week had elapsed and were lost to follow up. Of those babies that were analyzed; there was 45% case fatality rate in the 1st week of life.

Relationship between apgar score and outcome

Table 15: Five minute apgar score and outcome in 24 hrs

Apgar score	dead	alive	total
0-3	10	19	29
4-6	11	189	200
total	21	208	229

When apgar score and risk of death was analysed, an apgar score of 0-3 at 5 min carried significant risk of death within 24 hours (OR= 9.04 95%, CI 3.07,26.8; p < 0.001)

Table 16: Five minute apgar score and outcome on day 7

Apgar score	dead	alive	TOTAL
0-3	27	2	29
4-6	68	111	179
TOTAL	95	113	208

When apgar score and risk of death was analyzed, an apgar score of 0-3 at 5 min carried significant risk of death at day 7 (OR = 22.04, 95% CI 4.86,138; p< 0.001)

Table 17: Relationship between sex and mortality in the first 24hrs

sex	dead	alive	total
male	11	121	132
female	10	87	97
	21	208	229

There was no relationship between sex and mortality in the first 24 hrs

(Odds ratio=0.79, 95%CI=0.36,1.83; p =0.07)

Table 18: Relationship between sex and mortality within the first 7days

sex	Dead	Alive	Total
Male	63	58	121
Female	32	55	87
	95	113	208

Male babies are 1.87 times more likely to die than female babies.

(OR=1.87, 95% CI1.02, 3.41; p =0.04).

Relationship between birth weight and mortality at day 7 is shown in table 19

Table 19: Relationship between birth weight and mortality within the first 7 days

Birth weight	Dead	Alive	Total
1500-2499	28	28	56
≥ 2500	67	85	152
Total	95	113	208

Low birth weight neonates with asphyxia were not associated with an increased risk of death than their counterparts with normal birth weight (OR 1.37, CI 0.86-1.64, p = 0.398)

DISCUSSION

As the data collected was only for asphyxiated singleton live births with a birth weight of 1500g or more and their mothers, comparisons with all deliveries at UTH was not possible. In keeping with the descriptive nature of the deliveries at UTH, the data was presented in categories. Relative frequencies were calculated so as to be able to compare directly.

The study had initially planned to recruit 370 cases. This was based on an estimated prevalence of 50%. However, the study found a much lower prevalence rate of 5%. Had this prevalence rate being used, then the sample size required at 95% confidence level would have been 123 cases. The study, however recruited 229 consecutive cases .

Incidence

There is no general consensus on what constitutes birth asphyxia and various definitions have been used. The mostly used indicator of fetal condition at birth is the apgar score. A low apgar score of less than or equal to 6 at 5 minutes has been used as being synonymous with asphyxia in several studies (4, 44,47).

The incidence of birth asphyxia varies according to the definition and population studied. As a result, comparisons between studies are rather difficult. Because severely pre-term and grossly abnormal babies have a higher risk for birth asphyxia than their more mature and normal counterparts, only singleton babies weighing more than or equal to 1500g and did not have gross fetal abnormalities were included

in the study. Gestational age was not used to ascertain fetal maturity because it's accurate determination is not always possible.

Using an apgar score of 6 or less at 5 minutes, the incidence of birth asphyxia at UTH was 50/ 1000 live births. When only term infants are considered, the incidence of birth asphyxia was 43 / 1000 live births. This is similar to the incidence found in South Africa. It is however higher than that found in developed countries. A study done in Zimbabwe showed a lower incidence of 15 / 1000(56). One would have expected the incidence to be similar since Zambia and Zimbabwe are both developing countries with a homogenous population. The marked difference can be explained on the basis of the different definition of low apgar score used. A multi-center study in East, Central and Southern Africa found an incidence of birth asphyxia to be 21% (4) which was much higher compared to the 5% found by this study. One reason to explain this huge discrepancy is that the population studied were different and this was multi- center. A much lower incidence of 5.4/ 1000 was found in Sweden, a developed country with better health facilities (54).

Antenatal care

For antenatal risk factors to identified mothers need to attend antenatal clinic. The role of antenatal care in reducing perinatal mortality and morbidity is well known. It is also emphasized that the quality is probably more important than it's frequency. In this study the mothers of asphyxiated babies had a high attendance rate with 77% having more than 4 visits. Only 2% of the mothers did not have any antenatal visits. This low figure is rather surprising because lack of antenatal care is considered to be

associated with poor pregnancy outcome. Therefore a higher number would have been expected. Interestingly, a study in Zimbabwe found that absence of antenatal care was not a significant risk for low apgar score (56).

Only 52% of the mothers had an haemoglobin estimation done. This is quite low considering that Hb estimation is a basic investigation which all pregnant women should have. It may be a reflection of the quality of antenatal care being provided. 17.5% of the mothers were identified to have medical disorders complicating the index pregnancy. In a significant number of cases no antenatal risk factors were identified. This observation is in agreement with a study done in Finland that found that most cases of intra-partum fetal asphyxia occurred in low risk pregnancies (57). It would be interesting to find out the influence of booking status on asphyxia.

Maternal age and parity

The study revealed a higher proportion of teenager mothers of cases at 29.4% compared to the general population of mothers delivering at UTH which was 20% (65). Teenager pregnancy is a known risk factor for unfavorable fetal outcome which include low birth weight and low apgar score among others (4). Sixty out of 67 teenagers were primigravidas. It would be interesting to find out how primiparity and maternal age independently affect fetal outcome in a future study. Fifty-five percent of the mothers were primiparous while 9.2% were grand-multiparous. Primiparity has been identified to be a risk factor for asphyxia in many studies (4,44,57) The high prevalence of primigravidas found in this study is therefore not surprising. In

a study done in Zimbabwe and Malawi the prevalence of primiparous women delivering newborns with low apgar score was 60% and 79% respectively (58,60). In order to assess maternal age and parity as risk factors for asphyxia data would be required for all women who had delivered infants with apgar score ≥ 7 and those with low apgar score at 5 min. This can be addressed in a future study.

The study revealed that most of the mothers were housewives (78%), with low educational status (79.9%) and resided in high density areas. These factors are associated with low social economical status. However, this study could not determine the effect of low social economic status on birth asphyxia.

Intra-patum

The presence of abnormal intra-partum CTG, meconium staining of liquor and fetal distress are usually considered to reflect intrapartum hypoxia. Intrapartum CTG is not consistently done at UTH and was therefore not included in the analysis.

Fetal distress, usually diagnosed on the basis of abnormal fetal heart rate and occasionally with meconium stained liquor, was present in 30% of cases. It was also the commonest indication for c/s. Fetal distress is recognized to be related to asphyxia with the implication that it can be prevented. Close monitoring of fetal heart in labour will assist to identify fetus at risk and interventions can be taken to prevent low apgar score.

Meconium staining of liquor is present in 9-14% of all deliveries(58). When it is associated with abnormal fetal heart rate it's sensitivity in predicting poor fetal outcome is increased. Meconium staining of liquor was present in 23% of cases which is higher than that of the general population. During labour, liquor should be examined for colour and smell. When thick meconium is detected, measures should be undertaken to deliver the fetus as quickly as possible and direct suctioning of the baby's airway should be carried out to prevent meconium aspiration syndrome.

Prolonged labour, both first and second stage, was present in 46% of the cases. A study in South Africa found a prevalence of 34% among cases of low apgar score (44). Several studies have identified prolonged labour as a risk factor for asphyxia (4,44,56). Judicious use of the partogram would reduce the occurrence of prolonged labour. When signs of delay of labour are identified, appropriate action needs to be undertaken. Intervention can be in form of referral to a higher level of obstetrical care, augmentation of labour or surgical if there are signs of fetal compromise or obstruction of labour.

Pre-labour rupture of membranes lasting more than 24hrs has been associated with an increased perinatal morbidity and mortality. It is said to occur in 10% in all deliveries (44). This study found an incidence of 12%. A case control study should be done to determine the relative risk of PROM for asphyxia.

An intrapartum accident occurred in 12% of cases and is similar to a multi center study that found 10% (4). Intra-partum accidents carry a high risk for an unfavorable fetal outcome. They are unpredictable and can only be addressed if there is access to

trained birth attendants, good referral system and availability of facilities to enable immediate surgical intervention. A rapid response to such an emergency may help to mitigate the consequences.

13.5% of the fetuses had an abnormal presentation. All the 19 (8.7%) babies with breech presentation who had asphyxia were delivered vaginally except for one. The incidence of asphyxia in babies that presented as breech was 13.3%. This is significantly higher than the overall incidence of 5%. Vaginal breech delivery is associated with increased perinatal morbidity and mortality. Caesarean section may help to reduce the prevalence of poor fetal outcome in selected cases.

The c/s rate among the cases was 35.4% which was higher than that of the general c/s of 12.5% during the study period. Fifty percent of the babies delivered by c/s died within seven days. The concern, however is the associated increased risk of maternal morbidity and mortality and the implication of c/s on future deliveries. The morbidity and mortality associated with c/s are in the order of 5 and < 1% in developed countries respectively (66,67). The impact of c/s on the reduction of birth asphyxia and its associated maternal morbidity and mortality in a developing country needs to be assessed. The fetal condition at the time the decision to perform a caesarean section and the time interval taken to actually deliver the baby as well as the appropriateness of the resuscitation measures undertaken will determine the fetal outcome.

Fetal outcome

The chances of survival in the neonatal period of a baby born with a five minutes apgar score ≤ 6 at UTH are not very good. In this study the case fatality rate was 9.2% in the first 24 hours and 45% in the first week of life. Of those babies whose apgar score remained ≤ 3 at 5 minutes, 93% (27/29) died. A study in Harare, Zimbabwe found a case fatality rate of 41.2% in the first week of life (57). This is similar to that found in this study. A much higher case fatality rate of 74% was found in India (59). Nelson et al in a prospective study in the USA found that apgar score of 0-3 at 5min was an ominous finding with 44% of the newborns dying and 5% of the survivors showed evidence of disability (61). A prospective study to determine the long term neurological deficits in surviving neonates is recommended. There were more male 132(57.6%) babies with asphyxia than females 97 (42.4%). The study was also able to show that male babies were 1.4 times likely to die than female babies. A study in Finland found that male babies have an increased risk for birth asphyxia (relative risk 1.49) than females (57). Neonatal resuscitation can prevent morbidity and mortality. When adequate and appropriate resuscitation is carried out, even severely asphyxiated babies can survive with few sequelae. In this study 66% of newborns improved their one minute apgar score from 0-3 to 4-6 at 5 min. In a Swedish study a lower mortality rate of 27% of term infants with apgar score of 0-3 at one minute was attributed to good resuscitation and post delivery care (62). Twenty (8.8%) babies born with low apgar score did not have any antenatal risk factor or an obstetric complication. Congenital abnormalities not detectable by external examination may explain this finding. Cardiac abnormalities as a cause of

birth asphyxia were first recognized in the 1970s (63). Thorough examination in such neonates will assist to make the correct diagnosis and then institute the appropriate management.

STUDY LIMITATIONS

This was a hospital based study, therefore the results cannot be generalized.

Considering that UTH is a referral hospital, most women delivering at UTH already have risk factors for adverse pregnancy outcomes and therefore the incidence of asphyxia is expected to be high.

Although consecutive cases were recruited prospectively, the analysis of intrapartum events was done retrospectively. Therefore, it was not possible to analyze all variables of interest because some important information was missing .

A study that includes all deliveries at a given period or a case control study will be able to determine risk factors for birth asphyxia. This could be done using comparative analysis of factors like parity, age, intrapartum events etc.

The entry criteria for the cases was based on birth weight and apgar score at five minutes. The apgar scoring system, however is subjective and suffers both inter and intra observer variations. The implication of this is that some cases included could have being excluded or vice versa.

CONCLUSION

This study has demonstrated that birth asphyxia defined as an apgar score of less than or equal to 6 at five minutes is a common problem at UTH with one in every twenty babies being affected. Of the known obstetric risk factors for asphyxia, prolonged labour was the commonest and was identified in 46% of the cases. It reflects to a certain degree the quality of intra-partum care. There is need to enhance the interpretation of the partogram. Prolonged labour is a potentially preventable contributor to newborn asphyxia as well as morbidity and mortality.

The study has also shown that antenatal attendance was rather high. The emphasis on antenatal care should be more on quality rather than quantity alone.

The case fatality rate in the first week of life of the asphyxiated neonates was extremely high. Improved obstetric care and appropriate management of the newborn at delivery and in the neonatal period may help to reduce morbidity and mortality in some of these babies.

RECOMMENDATIONS

Bearing in mind the limitations of this study, the following recommendations can nevertheless be made:

- evaluate the quality of antenatal care
- improve intra-partum management with the appropriate usage of the partogram as a tool for monitoring labour with the view of reducing the occurrence of prolonged labour
- revisit intra-partum care and resuscitation of the newborn
- this study should be followed up with a cohort study that will attempt to establish the relative risk factors of birth asphyxia in term babies
- launch awareness campaigns in schools and communities to prevent teenager pregnancies

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INFORMED CONSENT FORM

**STUDY OF INCIDENCE AND FACTORS ASSOCIATED
WITH BIRTH ASPHYXIA
AT UNIVERSITY TEACHING HOSPITAL, LUSAKA**

This study aims to find out the incidence and factors associated with birth asphyxia at the University Teaching Hospital, Lusaka.

In order for the study to be conducted consent is being sought from you.
Information obtained will be confidential

Participation is voluntary and that refusal will not involve any penalty or loss of benefit.
Your cooperation is highly appreciated

I agree /disagree to participate in the study.

Signature of participant.....

Thumb print.....

DATA COLLECTION SHEET

TO DETERMINE THE INCIDENCES AND FACTORS ASSOCIATED WITH BIRTH ASPHYXIA OF THE NEWBORN AT LABOUR WARD, UNIVERSITY TEACHING HOSPITAL LUSAKA.

ANTEPARTUM

1. Demographic features

File No..... Age..... Sex.....
 Parity..... Gravidity..... Gestation Age.....
 Occupations..... Residential area Low density.....
 Education Status – Nil ;Pry;Sec;Col;Uni Medium density.....
 WT..... High density

2. Antenatal Risk factors

Hb..... VDRL..... No. of antenatal visits.....
 Multiple pregnancy Y /N

3. Past obstetrics performance

1. Previous Caesarean Section Y /N If yes No
 2. Instrumental delivery Y /N If yes Forceps/ ventouse
 3. IOL Y /N If yes Indication.....
 4. SVD Y /N 5. FSB Y /N 6. MSB Y /N
 7. Miscarriage Y /N No.....

4. Medical Disorders

HTN Y /N
 Pre-eclampsia Y /N
 DM Y /N
 Cardiac Disease Y /N
 Anaemia Y /N

Others

5. INTRAPATUM

UTH - Booked PT / Self referral

Clinic referral.....

Reason for referring

.....

Diagnosis at UTH

Time of referral.....

Time of arrival at UTH.....

6. CONDUCT OF LABOUR

On set of labour: spontaneous/induction.....
If induction, mode..... Indication.....
Duration of labour 1st stage..... 2nd stage.....
Augmentation Y / N Dosage of syntocinon.....
PROM Y / N Duration before onset of labourhrs

Presenting Part Ceph/ Breech, Type of Breech- footling/flexed/ frank
Position of PP.....

Fetal condition during labour?- Good Y / N
Compromised - Meconium staining of liquor - Y / N Grade
- CTG reactive / non reactive
- Fetal distress

Analgesia Y / N
Type.....
Interval between analgesia given and delivery.....

7. Intrapartum Accidents Y / N

- Abruptio
- Placenta Preavia
- Cord prolapse
- Ruptured uterus

8. Mode of Delivery

SVD Y / N
Assisted Breech Y / N
Instrumental: Y / N Type..... Indication.....
Caesarean Section Y / N Indication.....
Time interval between decision to do C/S and time of birth.....
Labour conducted by: Midwife, JRMO, SRMO, Registrar, SR, Consultant

9. Outcome

Wt of Baby.....gm. Sex M / F D.O.B.../.../... Time.....
Apgar Score at 1 min.....
5 min.....

10. Resuscitation measures

Suction
O2
Intubation
Drugs Y / N Specify.....

11. Admission to D Block Y / N

Outcome of Baby in 24hours Alive/Dead
7 days Alive/Dead