INTRODUCTION

The umbilical cord and placenta function as a unit in the fetomaternal gaseous exchange, nutrition, and other metabolites transfer. The umbilical cord which connects the fetus to the placenta contains fetal vessels and is essential for fetal survival. Umbilical cord prolapse can either be occult or overt. In the occult type, the umbilical cord lies alongside with the presenting part of the fetus, the cord however slips past the fetal presenting part to present either at the cervix or descend into the vagina up to the introitus in overt cases. The amniotic membrane has however ruptured in both cases. In umbilical cord presentation, the cord lies below the fetal presenting part within the lower uterine segment with the fetal membranes intact. This has a better prognosis compared with cord prolapse.

Umbilical cord prolapse is an acute obstetric emergency leading to compression and/or spasm of the fetal vessels from contact irritation and local temperature changes. This may lead to fetal circulatory compromise, fetal

ABSTRACT

Background: Umbilical cord prolapse is an obstetric emergency which is associated with significant perinatal mortality and morbidity as well as long-term handicap.

Objectives: The objective of this study was to determine the incidence of cord prolapse, elucidate the risk factors as well as the fetal outcome at the Lagos University Teaching Hospital (LUTH).

Design and Setting: A retrospective study at a tertiary care center in Lagos, Nigeria.

Materials and Methods: A descriptive retrospective study of all pregnancies complicated by prolapse of the umbilical cord in LUTH from January 1, 2001 to December 31, 2010.

Results: A total of 13,592 deliveries were conducted during the study period and 52 of which were complicated by cord prolapse at various cervical dilatations, thus giving an incidence of 3.8/1000 deliveries. Umbilical cord prolapses occurred commonly in women with multiple parities (51.9%), pregnancies with abnormal presentations (breech precisely) in 42.3%, abnormal lie in 30.8% with majority of the cord prolapse occurring after spontaneous membrane rupture (73.1%) while 26.9% occurred following amniotomy. Twenty-nine (55.8%) cases occurred outside the hospital setting; 69.2% of the children affected were term. The mean diagnosis–delivery interval was 53.3 ± 25.5 min, and cesarean section was the mode of delivery in 84.6%. Twenty-five percent of the children had Apgar score of ≥7 at the 1st min of life increasing to 69.2% at 5 min. The perinatal mortality was however 19.2%. Conclusion: Umbilical cord prolapse is associated with a significant perinatal mortality in this study, especially in those with spontaneous rupture of membranes that occurred outside the hospital setting.

Key words: Incidence, Nigeria, perinatal outcome, risk factors, umbilical cord prolapse.
hypoxia, acidosis, fetal brain damage, and intrauterine fetal death or early neonatal death.\textsuperscript{1,3}

The overall incidence of umbilical cord prolapses from studies range from 1 to 6 per 1000 deliveries (0.14\% to 0.62\%)\textsuperscript{5,6} and this has remained constant over the past two decades. A study done in the United States of America revealed an incidence of 0.2\%\textsuperscript{7} France, Singapore, and Turkey have similar incidences between 0.12\% and 0.14\%,\textsuperscript{8,9} an incidence of 0.28\% was found in Mali\textsuperscript{10} while incidences of 0.19\%-0.47\% has been reported in some cities in Nigeria.\textsuperscript{1,11,12} Most of these studies recorded the incidence of overt cord prolapse as most occult cord prolapse go unrecognized until they become overt.

Risk factors such as malpresentation,\textsuperscript{1,11} abnormal lie,\textsuperscript{13,14} prematurity, multiparity, polyhydramnios, and multiple gestation (with second usually more involved) have also been identified.\textsuperscript{11} Others include fetal congenital anomaly, pelvic tumors, marginally sited umbilical cord in a low lying placenta,\textsuperscript{11} abnormal long umbilical cord (length of >75 cm),\textsuperscript{15} spontaneous premature or prelabor rupture of membrane, amniotomy, fetal scalp electrode, intrauterine pressure catheter placement, and external cephalic or internal podalic version have all been associated with umbilical cord prolapse.\textsuperscript{1}

Diagnosis of umbilical cord prolapse is basically clinical and the outcome is dependent on the promptness and appropriateness of the interventions adopted to alleviate fetal cord compression, resuscitate the fetus in utero and expedite delivery.

**MATERIALS AND METHODS**

This was a descriptive retrospective study carried out in Lagos University Teaching Hospital (LUTH), Lagos, Nigeria. All the deliveries conducted in the hospital from the January 1, 2001 to December 31, 2010 were compiled from the labor ward register, and the cases complicated with umbilical cord prolapse were identified. Their case records were retrieved from the medical records library and each reviewed with particular reference to the sociodemographic parameters and the booking status of the mothers. The gestational age and the setting at which the cord accident occurred as well as the predisposing factors, diagnosis–delivery interval, mode of delivery, and the fetal outcome were also noted.

The records of all the children who had cord prolapse and were admitted into the special care baby unit following delivery were also reviewed and the outcome of their care noted.

The obtained data were analyzed with an Epi-Info statistical package, version 3.4.3 (Centers for Disease Control and Prevention, Atlanta, USA). Results obtained were expressed in tables and the significance of some specific variables with the fetal outcome was assessed. Categorical variables were compared with Chi-square test and Fisher’s exact test as appropriate while continuous variables were compared with t-test. \( P < 0.05 \) was considered as statistically significant.

**RESULTS**

**Incidence of cord prolapses**

During the 10-year study period, a total of 13,592 deliveries were conducted at LUTH labor ward. Of these, 52 women had cord prolapse giving an incidence of cord prolapse of 0.38\%. Table 1 shows yearly pattern of admission of patients during study period and yearly incidence of cord prolapse. In 2005, the lowest number of deliveries was conducted (457 deliveries) and the incidence of cord prolapse was highest (0.66\%). The lowest incidence of cord prolapse was in 2008 (0.11\%). However, this study did not show any statistically significant difference in the yearly incidence of cord prolapse during study period \( (P = 0.2424) \).

**Clinical profile of patient population**

Of the patients who had cord prolapse, 51.9\% were multiparas as shown in Table 2. Twenty-nine (55.8\%) were booked while 23 (44.2\%) were unbooked patients. Twenty-nine (55.8\%) of the cases occurred outside the hospital setting while 23 (44.2\%) occurred in the hospital. Most of the patients had cord prolapse following...
spontaneous rupture of membrane (38; 73.1%) while in 14 cases (26.9%), it followed artificial rupture of membrane. In 43 cases (82.7%), it occurred in singleton pregnancies, while in nine cases (17.3%), it occurred in twin pregnancies. In 36 cases (69.2%), the pregnancy was at term, while in the remaining 16 (30.8%), it was preterm. The mean gestational age was 36.6 ± 3.5 weeks (range: 29–42 weeks). The median gestational age was 37 weeks which was also the modal gestational age. Cesarean section was the mode of delivery in 44 (84.6%), operative vaginal delivery (forceps) in 6 (11.6%), and spontaneous vaginal delivery in 2 (3.8%) women.

Factors predisposing to cord prolapse
The identifiable predisposing factors to cord prolapse in this study were multiparity in 53.8% of the patient’s population, abnormal presentation in 42.3%, and abnormal lie in 30.8% of the patient’s population. Only one patient had polyhydramnios (1.9%). Other factors identified were prematurity, preterm prelabor rupture of membrane, uterine fibroid, multiple gestations, and artificial rupture of membrane [Table 3].

Perinatal outcome in cord prolapse
Prior to delivery, 45 fetuses were observed to be alive while seven were confirmed dead. There were nine stillbirths and one early neonatal death, giving a perinatal mortality rate for cord prolapse of 19.2%. Eighty percent (eight cases) of the perinatal deaths resulted from cases of cord prolapse that occurred outside the hospital, of which seven cases were from unbooked patients. Forty-two (80.8%) affected children survived the short-time effect of the obstetric accident.

Determinant of perinatal outcome
The diagnosis–delivery time interval of the cases with viable fetus at presentation was 53.3 ± 25.5 min (range 10–95 min). For the cases of cord prolapse that occurred within the hospital, the average diagnosis–delivery time interval was 35.9 ± 16.4 min (range: 10–82 min). The analysis showed a statistically significant difference as well as a clinical significance when compared with the perinatal outcome ($P = 0.0334$). Eight women (15.4%) delivered within 30 min while 44 (84.6%) delivered over 30 min of diagnosis. The reasons for delay in the delivery of these 44 patients were unavailability of theater space in 20 (45.5%), preoperative preparations including anesthetist review in 12 (27.3%), lack of operative materials in 6 (13.6%), and dead fetus in 6 (13.6%). There was no significant relationship between the gestational age of the fetus at cord prolapse and their perinatal outcome ($P = 0.0916$). There was however a significance relationship between mode of delivery and perinatal outcome with those who had cesarean section doing better ($P = 0.013$) [Table 4]. No statistically significant difference exist between the other measures taken during intrauterine fetal resuscitation instituted prior to delivery ($P = 0.5720$) [Table 5], the type of anesthesia applied at cesarean delivery ($P = 0.5779$), and the perinatal outcome.

DISCUSSION
Umbilical cord prolapse is an obstetric emergency which can result in a significant perinatal mortality or long-term neurological morbidity. The incidence of cord prolapse from the study in the LUTH was 0.38% (3.8/1000 deliveries). The above value mainly represent the incidence of overt cord prolapse in the hospital. It is however possible that some unexplained fresh stillbirth recorded particularly among the unbooked patients in this study could have been the result of occult cord compression that went unrecognized, especially in an environment where continuous intrapartum electronic fetal monitoring is not yet the norm. The implication of this is that the real incidence may even be higher than this figure. However, the incidence from this study is still within the general range observed in most other international and local studies.\textsuperscript{1,2,5-11,16}

### Table 3: Identified predisposing factors to cord prolapse

| Predisposing factors          | Frequency | Percentage |
|------------------------------|-----------|------------|
| Multiparity                  | 28        | 53.8       |
| Abnormal presentation        | 22        | 42.3       |
| Abnormal lie                 | 16        | 30.8       |
| Preterm prelabor rupture of membranes | 16    | 30.8       |
| Prematurity                  | 15        | 28.9       |
| Artificial rupture of membranes | 14     | 26.9       |
| Multiple gestation           | 9         | 17.3       |
| Uterine fibroid              | 4         | 7.7        |
| Polyhydramnios               | 1         | 1.9        |

There are multiple predisposing factors observed in some of the patients.

### Table 4: Mode of deliveries and fetal outcome

| Mode of deliveries          | Alive | Perinatal death | Total |
|-----------------------------|-------|-----------------|-------|
| Cesarean section            | 37    | 7               | 44    |
| Operative vaginal delivery  | 5     | 1               | 6     |
| Spontaneous vaginal delivery| 0     | 2               | 2     |
| Total                       | 42    | 10              | 52    |

$P = 0.013$

### Table 5: Other measures taken during in utero fetal resuscitation before delivery

| Other measures                        | Frequency | Percentage |
|---------------------------------------|-----------|------------|
| Bladder filling with saline           | 17        | 28.8       |
| Maternal oxygenation by face mask     | 16        | 27.1       |
| Trendelenburg positioning             | 12        | 20.3       |
| No additional measures                | 7         | 11.8       |
| Manual replacement of cord            | 3         | 5.0        |
| Cord packing with moist saline gauze   | 3         | 5.0        |
| Tocolysis                             | 1         | 1.7        |

$P = 0.5720$. Multiple measures were adopted in some of the patients during in utero fetal resuscitation before delivery.
More than half (51.9%) of the women in this study were multiparous, though not as high as 78.3% in one study, where multiparity was found to be the most common and most significant predisposing factor to cord prolapse. Multiparity has been associated with an increased relaxation of the uterine myometrium, degenerative changes in the endometrium, and laxation of the anterior abdominal wall. These associations are the risk factors for abnormal presentation, abnormal lie, abnormal placentation, and premature rupture of fetal membrane that as well predispose a multigravida woman to cord prolapse.

Abnormal presentation was responsible for 42.3% of the cases in this study which is lower than 53% in a study done in Pakistan and higher when compared to 39.1% from a study done in South-East Nigeria. Prematurity was, however, associated with 28.9% of the cord prolapse in this study.

Artificial rupture of membrane, when performed too early in the course of labor prior to proper engagement of the fetal presenting part, may result to this obstetric disaster. In this study, 26.9% of the cord prolapse occurred following amniotomy. The outcomes of the fetuses in this category of cord prolapse were better as a result of prompt intervention within the setting of a standard health facility compared to those that resulted from spontaneous membrane rupture. Spontaneous rupture of membrane accounted for 73.1% of cases of cord prolapse in this study. The perinatal death (80.0%) associated with the cases of cord prolapse following spontaneous rupture of membrane was clinically significant. This is similar to another study where 71.8% of the cord prolapse following spontaneous rupture membrane occurred outside the hospital setting, of which 84% were in unbooked women. The above observations revealed the importance of a hospital-managed labor and supervised delivery, during which an immediate vaginal examination can be performed to exclude prolapsed cord in a gravid woman, at the event of spontaneous membrane rupture or observation of an ominous cardio-tocographic tracing in labor. Thus continuous health education of the gravid woman cannot be over-emphasized.

The outcome of any fetus affected by cord prolapse depends on a number of factors, each of which could be acting solely or in synergy with others. These include, the gestational age, duration of cord compression before interventional measure is instituted (diagnosis–delivery interval), the efficiency of the intrauterine resuscitation, and the definitive management adopted as well as the standard of the available neonatal care.

The perinatal mortality rate from this study was 19.2%. This was much lower compared to the findings in Abakaliki, (41.3%); Ibadan, (40.3%); Benin, (28%); and Maiduguri, (27.3%) which are different cities in different parts of the same country, Nigeria. This could be because, Lagos, a major city and former capital city in Nigeria, has better health facilities than these other cities. Other international studies had previously reported perinatal mortality rate of 36% to as high as 91% from umbilical cord prolapse.

The single mortality recoded in one of the cases of cord prolapse which occurred in a booked patient within the hospital may partly be explained by the multiple congenital abnormalities (omphalocele, congenital posterior urethral valve diagnosed through antenatal ultrasound, microcephaly) obvious in the fetus at birth.

The ideal intervention on the event of cord prolapse with fetus alive is prompt delivery by the fastest route. The choice and the promptness of such intervention constitute important determinants of the fetal outcome. The factors affecting the immediate management of cord prolapses include fetal viability, fetal maturity, and the presence of any significant life-threatening anomaly. Emergency delivery is recommended for a live and mature fetus. In the first stage of labor with partially dilated cervix, a cesarean section is the only way to achieve early delivery. However, with a completely dilated cervix, the obstetrician has a choice between instrumental vaginal delivery and cesarean section. Some studies have quoted more favorable outcomes with cesarean section even in the second stage of labor. In this study, 44 (84.6%) fetuses were delivered by cesarean delivery, 6 (11.5%) by operative vaginal delivery, and 2 (3.9%) by spontaneous vaginal delivery.

The diagnosis–delivery interval has been observed to be directly related to the degree of asphyxia suffered by a fetus during cord prolapse and therefore noted as a determinant of fetal outcome. The German Society of Gynecologists and Obstetricians recommend a maximum decision to delivery time of 20 min to achieve a favorable fetal outcome. The American College of Obstetricians and Gynecologists and the American Academy of Pediatrics in jointly developed guidelines for perinatal care, however, believes the maximum decision to incision time of 30 min is appropriate. The mean diagnosis–delivery interval in this study was 35.9 ± 16.4 min for those cases of cord prolapses occurred, the mean diagnosis–delivery interval of 53.3 ± 25.5 min was observed. Of all deliveries in this study, 69.2% infants had an Apgar score of ≥7 in the 5th min of life. However, 15.4% of them were delivered within the recommended time of 30 min diagnosis–delivery interval, while 84.6% were delivered after this time limit. This finding is not too different from the sentinel caesarean section audit in the United Kingdom which suggested that in cases of cord prolapse, a diagnosis–delivery interval of 15 min was feasible but in many cases delivery within 30 min was not achieved.
It has been found that delivery within 75 min appears not to increase the risk of compromise just as delivery within 30 min may not always result in good perinatal outcome.\textsuperscript{22,23} This therefore suggests that rather than the diagnosis-delivery interval being the main determinant of the perinatal outcome in cord prolapse, quite a lot of factors act in synergy to determine the perinatal outcome of a neonate affected by this obstetric complication. Some of these apart from the time frame of intervention may include the effectiveness of the in utero resuscitative, measures adopted on recognition of the accident, the efficiency of the neonatal care, maternal health status, the fetal maturity, and other fetal intrinsic factors yet to be identified.

Instillation of 500 ml of normal saline into the urinary bladder and administration of oxygen through face mask to the mother were the common additional measures taken during intraterine resuscitation in most cases of the cord prolapse. Prolapse of umbilical cord is an obstetric emergency with a well-documented grave fetal prognosis in poorly equipped obstetric centers. A high index of suspicion and recognition of predisposing factors during antenatal care period may allow for early detection and timely delivery, thereby minimizing perinatal morbidity and mortality. The importance of hospital-based supervised delivery is advocated in the event of an obstetric emergency, a multidisciplinary approach to organization and conduct of an emergency delivery is essential in every case of cord prolapse to minimize its associated risk of perinatal mortality and long-term neurological complications.

**CONCLUSION**

Umbilical cord prolapse is associated with significant perinatal mortality in this study especially in those with spontaneous rupture of membranes that occurred outside the hospital setting.

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**Conflicts of interest**

There are no conflicts of interest.

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