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SCHOOL OF MEDICINE

**CHARACTERISTICS AND DETERMINANTS OF
CAESAREAN SECTION AND CORD PROLAPSE
AT THE UNIVERSITY TEACHING HOSPITAL, LUSAKA**

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**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIREMENT AND FOR THE DEGREE OF MASTER OF MEDICINE
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DEDICATION

This work is dedicated to:-

My very loving and tolerant husband, Douglas Tshuma, who offered moral support and waited patiently for me to complete this work.

My dearest mother, Emily Malundu, who attended with all my extra-academic work while I worked on this dissertation.

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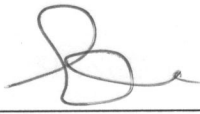
Ms Abigail Phiri who helped with the literature search

Above all I want to thank God, my Father – he alone deserves the praise

STATEMENT

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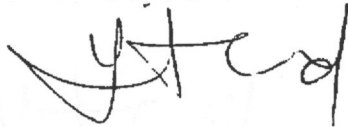
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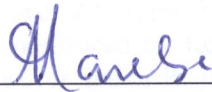
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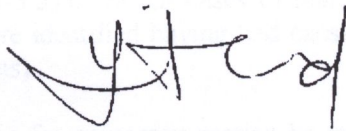
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SIGNATURES







ABSTRACT

Caesarean section

Caesarean section rates and their indications vary all over the world. Audit of indications and factors affecting infant and maternal outcome remain an important activity in rationalising the use of this major procedure in obstetric practice.

Over a period of one year in 1998, 1,880 caesarean sections were performed at the University Teaching Hospital, Lusaka, out of 10,525 total deliveries, giving an institutional caesarean section rate of 17.9%. The eight commonest indications for caesarean sections were: causes related to failure to progress in labour, including CPD (22.0%), previous caesarean section (19.3%), fetal distress or fetal compromise (15.2%), hypertensive disease in pregnancy (8.9%), malpresentation and abnormal lie (8.3%), breech presentation (6.9%), antepartum haemorrhage (APH) (6.3%), cord presentation and prolapse (4.1%). These constituted 91% of all indications. Caesarean section for failure to progress, fetal compromise, severe hypertensive disease and breech presentation were commoner in primiparas. Malpresentation (excluding breech) and cord presentation/prolapse were commoner indications in multiparas. 24.5% of caesareans were in preterm pregnancies. Severe hypertensive disease and APH were commoner in preterm compared to term pregnancies. All but 5 cases (0.3%) were performed under general anaesthesia.

7.0% of infants born at caesarean section were stillborn. After excluding cases of uterine rupture, APH (16.0%) and malpresentation (12.7%) had the higher case fatalities at caesarean section. Prematurity was associated with over 2.5 times the risk of stillbirth (OR 2.59, 95% CI 1.72-3.89). The majority of cases were performed by Registrars (62.7%) and Senior Resident Medical Officers (SRMOs) (26.2%). However Senior Registrars and Consultants who performed fewer but more complicated cases were over two fold more likely to have a stillbirth at caesarean section (OR 2.24, 95% CI 1.43-3.51). Seven cases of maternal mortality due to haemorrhage, post eclampsia and infection were identified having had caesarean section (maternal case fatality of 3.7 per 1000 caesarean sections).

It is recommended that: decisions for caesarean section be made at the highest level and at least at the Registrar level); more cases be performed under regional anaesthesia (e.g. spinal) and constant audit be made of management of labour to minimise the number of cases requiring caesarean section for failure to progress in labour.

Cord prolapse

Cord prolapse frequently leads to caesarean section and is associated with a high perinatal mortality and morbidity rate. Cases presenting to UTH in 1998 were studied in-depth to determine risk factors and outcomes.

63 cases of cord prolapse were identified (0.59% of deliveries at UTH). 58.7% occurred at home or at a local clinic requiring referral to UTH. The risk factors commonly associated with cord prolapse were malpresentation, prematurity, high presenting part and multiple pregnancy. In only 6 cases had there been an ARM. 30.1% were preterm. The majority (63.5%) presented as cephalic although 22.2% of cases were breech. 66.7% were delivered by caesarean section. Cases in which there was already fetal death in-utero were more likely to have a vaginal delivery. 37.5% of all infants were stillborn. A diagnosis-to-delivery interval of <60 minutes, rather than site of rupture of membranes was strongly associated with a liveborn outcome (OR 4.5, 95% CI 1.4-14.89).

Early diagnosis, prompt referral to UTH and judicious use of caesarean section in the management of cord prolapse is advocated.

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ABBREVIATIONS

APH	-	Antepartum Haemorrhage
ARM	-	Artificial Rupture of Membranes
AS	-	Apgar Score
BOH	-	Bad Obstetric History
CP	-	Cord Prolapse
CPD	-	Cephalopelvic disproportion
C/S	-	Caesarean Section
CTG	-	Cardiotocograph
ECV	-	External Cephalic Version
FHH	-	Fetal Heart Heard
FHNH	-	Fetal Heart Not Heard
GA	-	General Anaesthesia
IUD	-	Intra-Uterine Death
JRMO	-	Junior Resident Medical Officer
LC	-	Local Clinic
OR	-	Odds Ratio
PROM	-	Prelabour Rupture of Membranes
SA	-	Spinal Anaesthesia
SRM	-	Spontaneous Rupture of Membranes
SRMO	-	Senior Resident Medical Officer
UTH	-	University Teaching Hospital

INTRODUCTION

High caesarean section rates are a matter of concern both to the patient and to international public health (1). The caesarean section rate varies from place to place, ranging from 3% to over 50% of all deliveries. In the last few decades, the incidence of caesarean section has increased. For example, the National Maternity Hospital, Dublin has a well-documented increase over a century (1894-1994) but more so since the 1980's (2). The incidence had remained at less than 1% until the late 1950s. From 1954-1964, the incidence quadrupled to 4% and remained constantly low until the 1990s by which time it had doubled to 8%.

In Lusaka, approximately 45,000 deliveries are conducted each year, out of which over 10,000 are conducted at UTH and the rest at 10 urban maternity clinics with facilities for non-operative vaginal deliveries. The urban clinics refer all patients requiring caesarean section or instrumental deliveries to UTH.

In 1995 the caesarean section rate at UTH was 14.2% (1,868 of 13,185 total deliveries), 10.3% in 1996 (1,348 of 13,065) and 15.3% in 1997 (1,621 of 10,563). This study in 1998 set out to determine whether the incidence was increasing compared to previous years and to evaluate the indications for caesarean section so as to better understand and audit this form of delivery. Caesarean sections are associated with higher maternal mortality and morbidity compared to vaginal deliveries. Certain factors contribute towards the high incidence of caesarean section and if these could be identified, the caesarean section rate could be reduced and thus maternal morbidity and mortality associated with caesarean section reduced.

As an adjunct study, it was decided to audit an indication of caesarean section for which little information is available at UTH. Umbilical cord prolapse frequently leads to caesarean section being performed. The condition was therefore selected and studied to evaluate determinants and factors leading to cord prolapse, the management and outcome, including the role of caesarean section.

LITERATURE REVIEW

CAESAREAN SECTION

Definition and History

Caesarean section is the removal of a baby from the intact uterus by abdominal operation. The history of caesarean section can be traced back to 700 BC, Rome, when the procedure was used to remove infants from women who died late in pregnancy (3). In fact, some authors say, at first it was employed in the hope of obtaining a living child when the mother was dead, or so near death that maternal survival was not a practical consideration (4). In 1610 the first caesarean section was performed on a living patient (3). While the mother was still alive, some form of narcosis, usually with alcohol, was employed (4). With safer techniques of anaesthesia and antibiotics developed in the twentieth century, caesarean section delivery became and is now a common surgical procedure in many settings.

Classification of indications for caesarean section

Indications for caesarean section could be classified in various ways. They may be fetal or maternal, emergency or elective, absolute or relative indications etc (3,4). In this dissertation, caesarean sections will be classified as fetal, maternal and overlapping fetal/maternal indications as described below:

Fetal Indications	Maternal indications	Both fetal and maternal indications
a) Malpresentation/malposition <ul style="list-style-type: none"> • Breech • Transverse lie • Multiple pregnancy • Retained second twin • Face and brow presentation • Occipito-posterior position • Cord prolapse b) Fetal conditions <ul style="list-style-type: none"> • Fetal distress • Isommunisation • Very low birth weight 	a) Failure of labour to progress <ul style="list-style-type: none"> • Abnormal uterine contractions • Failed induction of labour b) Maternal conditions <ul style="list-style-type: none"> • Hypertensive disease • Diabetes Mellitus • Older primigravida • Previous vaginal surgery (e.g. Colporrhaphy, fistula repair) c) Repeat caesarean section.	a) Failure to progress <ul style="list-style-type: none"> • Cephalopelvic disproportion • Failed instrumental delivery b) Antepartum haemorrhage <ul style="list-style-type: none"> • Abruptio placentae • Placenta praevia

Indications of Caesarean Section and Increased Rates of Caesarean Section

As mentioned before, high cesarean section rates are a matter of concern to international public health (1). As a result, a number of studies have been conducted in various centers, particularly where caesarean section rates were noted to be increasing, in order to ascertain the reasons for the increase.

A recent large increase in caesarean sections in Italy led to a study to identify risk factors for caesarean section (5). Crude caesarean section rates in three hospitals were 29.4%, 15.7% and 16.1%. Variables identified as high risk factors were pre-eclampsia, previous section, breech and other non-vertex presentations, antenatal care under an obstetrician working in the same hospital, a low number of antenatal visits, previous miscarriages, offer by obstetrician and request by women for caesarean section. A physician factor was detected in all three hospitals where rates for different physicians ranged from 0-53%. The authors indicate that in Italy, caesarean section is widely performed for non-medical reasons.

In the Netherlands, trends of caesarean section rates were assessed for the interval 1983 to 1992 (6). It was found that rates of planned caesarean section appeared to increase more than the rates of emergency caesarean section and the increase for multiparae was greater than for primiparae. The largest increase was found within the medium risk group (namely singletons, term, vertex presentation, normal birth weight, mothers 20-35 years of age, normal blood pressure). Although no evident pathology could be found in the data, those women could not have belonged to the low risk group because they were referred to an obstetrician.

In a review of primary caesarean section in Tasmania, there was noted to be an increase in the rate from 4.3% in 1975 to 6.6% in 1982 (7). This was attributed to the increased incidence of primary caesarean section associated with breech presentation and fetal distress. The overall perinatal mortality rate fell from 19.5 per 1000 births in 1975 to 10.8 per 1000 births in 1982 but without a corresponding fall in perinatal mortality rate associated with primary caesarean section. The authors advise that, as an increase in caesarean section would lead to increased maternal mortality and morbidity, active review of the reasons for the increase in incidence of caesarean section should be undertaken by the hospitals where the rate is usually high (7).

In another study at a District General hospital, in Radom, Poland, there was noted to be an increase in the rate of caesarean section from 11.8% to 14.8% between 1985 and 1993 (8). The most frequent indications to perform caesarean section were: imminent intrauterine asphyxia of the fetus (25.4%), abnormal position of the fetus (17.7%) and non-progressive labour (9.9%). In all these groups, over 70% of the operations were performed in primiparae. In multiparae, common indications included cord prolapse, placenta praevia and abruptio placentae.

More cesarean sections are also being performed for prematurity. This is due to tremendous advances made in neonatology such that babies of 700 - 1500grams can be delivered abdominally and expected to develop normally (3).

A rise in the level of private practice has also contributed to the increased caesarean section rate. In considering the situation in third world cities, by 1985 it was noted that doctors gave a disproportionately high amount of attention to low-risk women (9). A significantly higher

proportion of caesarean section was performed among low-risk mothers than among high-risk mothers. It was postulated that financial reasons seemed to have markedly influenced the decision to perform cesarean section (9).

The extremes of childbearing age are associated with high caesarean section rates. In one study, there was a higher rate in teenagers (aged less than 20 years) than in those aged between 21 - 25 years (10). In another study, the frequency of caesarean section was found to be increased with advancing age. This is especially so as the rate of nulliparous births has increased by 50% in women aged 40 to 44 years in the last two decades, especially in developed countries (11).

Other significant contributions to the high rates of caesarean delivery are a concern for malpractice litigation (12) and the introduction of electronic fetal heart rate monitoring that has led to a higher rate of caesarean section for fetal distress (13).

Over a period between June, 1992 and September 1993, an analysis of indications for caesarean sections was conducted at Jimma Hospital in Ethiopia where the caesarean section rate was 8% of institutional deliveries. The leading indications for caesarean section were: cephalopelvic disproportion (44%), malpresentation and malposition (21%), repeat caesarean section (16%), antepartum haemorrhage (8%) and fetal distress (6%), accounting for 95% of the indications for caesarean section (14).

Complications Associated With Caesarean Section

The reason why high caesarean section rates have been of major concern is that up to the end of the nineteenth century, the maternal mortality from the operation was still high, mostly because of haemorrhage and infection (3). By 1870, the maternal death rate after caesarean section was about 75%. Initially, all these operations were of the classical type (vertical incision in the upper segment of the uterus) and this was one of the contributors to the high mortality because of excessive blood loss (4). However, advances in surgical and anaesthetic techniques, safe blood transfusion and the discovery of effective antibiotics have led to a dramatic reduction in the mortality rate. The introduction of lower segment caesarean section (LSCS) in the last half of the twentieth century has contributed further to the safety of caesarean section (4).

Currently, in developed countries, the maternal mortality after caesarean section is quoted as 0.5 per 1000 in elective sections or those caesarean sections uncomplicated with infection compared to 0.1 per 1000 following vaginal delivery. In cases of caesarean section complicated by infection, the rate is eight times higher. Some form of morbidity occurs in between 3-12% of caesarean sections depending on the indication. For example, caesarean section following premature rupture of fetal membranes for more than 18 hours duration carries a higher morbidity rate, with two thirds of cases complicating in endometritis and one third in urinary tract infection and wound infection (3). In the previously cited study at Jimma Hospital in Ethiopia there were no maternal deaths, but the overall morbidity rate was 20% (14). The causes of morbidity cited were: wound infection (27.1%), sepsis (21.4%), endometritis (33.3%), haemorrhage (8%) and wound dehiscence (10%).

Examples of early complications, apart from anaesthetic complications are: infections (endometritis, salpingitis, wound infections, urinary tract infection and pelvic abscess), wound dehiscence, haemorrhage from the wound or the placental site, injury to surrounding structures during the procedure (e.g. bladder, bowels, ureter), deep vein thrombosis, pulmonary embolism and paralytic ileus. Late complications include adhesions, resulting in intestinal obstruction and pelvic pain, subsequent rupture of uterus (3% of classical sections and 0.25% of lower segment sections rupture in late pregnancy), incisional hernia or divarication of rectus abdominis muscles (3,15).

A study in four hospitals in Zimbabwe in 1989 showed that after caesarean section, major complications were recorded in 15% and minor complications recorded in 27% of the patients (16). Only 53% of caesarean sections were devoid of any complications or need of blood transfusion in this study. Among the complications, infection morbidity was cited as being particularly frequent. The conclusion was that in a third world environment, caesarean section carries a substantial risk of operative and postoperative complications.

The ultimate complication associated with caesarean section is maternal mortality. In a paper entitled 'How safe is caesarean section?' in 1995; caesarean section deaths at one institution in India accounted for 1 in 8 of the overall maternal deaths in the hospital. The institutional mortality rate for caesarean section was 5.7 per 1000 caesareans (17).

Certain factors increase caesarean section related complications. For example, the conclusion in one study was that HIV positive mothers are at an increased risk of postoperative complications when delivered by caesarean section, the risk being higher in women who are

severely immune-suppressed (18). Another study cited the considerable postoperative morbidity associated with caesarean section in emergency operations more than in elective procedures (19). Other risk factors, other than emergency sections, leading to the development of infection, include low social category, rupture of membranes, number of vaginal examination and having been in labour before caesarean section (20).

Strategies to reduce caesarean section rates

Various studies have addressed techniques to reduce caesarean section rates. For example symphysiotomy can be practiced in some cases of lesser degrees of disproportion (1). An analysis of 65 symphysiotomies and 108 caesarean section performed between 1988 - 1994 after failed trial of assisted delivery at the Port Moresby General Hospital (Papua New Guinea) revealed no significant difference in perinatal or maternal outcome comparing the two procedures. Mothers who had a symphysiotomy required longer hospital stay but had few complications necessitating additional surgery, such as for wound infection, than women delivered by caesarean section. These findings illustrated that, with proper technique and selection of cases, symphysiotomy can both eliminate difficult vaginal delivery and reduce maternal morbidity and mortality associated with caesarean section (21).

Breech presentation is a common indication for caesarean section (1). Breech presentation contributes to a greater or lesser extent to a high caesarean section rate. External cephalic version (ECV) has received renewed interest in obstetrics as a strategy to avoid caesarean section in breech presentation. With the use of ultrasound, fetal monitoring and a beta-agonist, 25 pregnancies were managed with ECV and compared with 23 pregnancies managed without ECV in California (22). There was a 70% version success rate resulting in only a 30%

caesarean section rate compared with 75% when version were not attempted. Other authors have estimated that an active programme of breech version could reduce the expected 3-4% breech presentation rate at delivery by about half (23).

A trial of vaginal labour is safe in women with a history of caesarean section under controlled circumstances (1). For example, at Mercy Maternity Hospital in New Zealand, a 13.1% overall caesarean section rate was found with 39.1% of those being repeat caesarean sections. Over the 16 year period of study, the primary caesarean section rate increased from 6.6 to 9.3% while the incidence of repeat caesarean section increased from 2.7 to 6.8 %. Of the 4,892 patients with one or more previous caesarean section, 1,577 (32%) were allowed a trial of scar, 1,197 (75.9%) of whom achieved vaginal delivery (24). 13 (0.82%) patients sustained uterine rupture but there were no maternal mortalities.

A study on trial of labour after previous caesarean section in rural Zimbabwe was reported in 1997 (25). This was a case-control study, which compared outcome of labour of 281 women who had one or more previous caesarean sections to that of 4,501 women without a caesarean section uterine scar. No elective caesarean section was performed. Of the 281, 124 (44%) achieved a vaginal delivery and in one patient with thyrotoxicosis, the uterine scar ruptured (although with a good maternal outcome). Perinatal and maternal outcome did not differ significantly in the two groups. A history of more than one caesarean section or a previous caesarean section due to cephalopelvic disproportion increased the risk for a repeat caesarean section significantly. The conclusion was that a policy to allow all women a trial of labour after a previous caesarean section did not increase adverse pregnancy outcome. Even in rural Africa, it seems rational to encourage a trial of labour after one or more caesarean section, but

in a setting where there are experienced midwives and obstetricians to monitor the progress of labour (25).

Caesarean section for improperly diagnosed fetal distress (performed as an emergency) should be done with care, especially when the maternal mortality rate after such an operation exceeds 1-2/1000 (1). Evaluation of fetal scalp pH in addition to fetal heart monitoring may avoid caesarean section (26). However this may not be available in all centres, particularly in a developing country setting.

Although there might be benefit in performing caesarean section in cases of triplet pregnancy, or for a transverse lie in a second twin and for the prevention of vertical transmission of HIV infection, caesarean section has not yet become the safe procedure in developing countries as it is in developed countries. Alternative procedures such as version, extraction, vaginal breech or instrumental delivery and symphysiotomy are probably more applicable (1).

Analysis of deliveries in 12 hospitals between 1985 - 1886 in the Midlands province of Zimbabwe showed that a hospital with a higher caesarean section rate resorted to abdominal delivery more frequently for the controversial indications of unknown presentation, retained second twin, or delivery of a stillborn child (27). Hospitals with a high number of instrumental deliveries (vacuum extraction, forceps, symphysiotomy, and embryotomy) tended to have a reduced number of caesarean sections and vice versa. Hospitals with a higher caesarean section rate had no better obstetric outcomes than the other hospitals. Hospitals, which resorted more to instrumental deliveries, had lower maternal and perinatal mortality rates. The conclusion of the authors was that caesarean section should be the last resort.

This literature survey on caesarean section is not exhaustive. However, a number of issues have been outlined. It is important to know how many caesarean sections are being performed, why they are being performed, what complications they may have and what alternatives may exist to achieve a safe delivery for both mother and neonate.

LITERATURE REVIEW

UMBILICAL CORD PROLAPSE

Definition

Presentation of the umbilical cord (generally referred to as cord presentation) is when the cord lies enclosed within intact fetal membranes and is in front of or below the presenting part. Cord prolapse occurs after rupture of membranes and results in the cord appearing in the vagina and may even prolapse out of the vagina (15). Because of the resulting mechanical constriction of the cord (against pelvic structures) and/or vasoconstriction of the cord exposed to a colder atmosphere there is a risk of hypoxaemia to the fetus that can result in fetal death or the subsequent birth of an asphyxiated baby.

Incidence

Prolapse of the cord occurs in about 1 in 200 pregnancies – 0.5% (15). At Tsan Yuk Hospital, Hong Kong, for example, the incidence was found to be 0.17% (70 cases out of 41,939 deliveries) between 1976 - 1982 (28). At the Obafemi Awololo University Teaching Hospital complex, in Ile-Ife, Nigeria, it was 0.42% (1 in 240 deliveries) over a 10 year period (29). Cord prolapse occurred in 1 in 385 (0.26%) pregnancies at the University of Colorado Health Science Centre between 1969–1982 (30).

Etiology

Cord prolapse is caused by anything which interferes with the snug application of the presenting part in the lower uterine segment or its engagement in the pelvis, or which offers space between fetus and pelvis. A subsequent rupture of the membranes can then potentially cause the cord to slip out through that gap and into the vagina if the cervix is dilated. Among

the causes are malpresentation, prematurity, amniotomy and obstetric manipulation (15). Other causes are prelabour rupture of membranes, multiple pregnancy and during delivery of the second-born twin (29,31). The risk of cord prolapse in breech presentation is more with the footling breech as cited by a 1979 study on breech in Zambia (32). Cord prolapse occurs more often in multiparas (71%) than in primiparas (8).

Malpresentation is a particularly common cause; the risk of prolapse being greater the more marked the malpresentation. In a series of 400 cases, the incidence was as follows: uncomplicated vertex, 1 in 1,300; vertex, unengaged or with minor disproportion, 1 in 800; breech, 1 in 22; shoulder presentation or transverse lie, 1 in 5 (15). In studies on caesarean section for the second twin, one of the commonest indications was cord prolapse (33, 34).

Management of cord prolapse

The method of treatment to be employed in cord prolapse depends on the condition, maturity and lie of the fetus and also on the degree of cervical dilatation. As a principle, the longer the delay between detection of cord prolapse and delivery, the higher is the fetal mortality. If the fetus is dead and the lie is longitudinal, spontaneous vaginal delivery should be awaited. If the fetus is alive and sufficiently mature to survive, treatment depends on the degree of cervical dilatation. Unless the cervix is fully or almost fully dilated, the lie is longitudinal and either instrumental delivery or breech extraction is possible, the safest management is otherwise by immediate caesarean section. If the lie is abnormal, caesarean section is preferred to the older method of internal version and breech extraction (15). Whilst preparations for caesarean section are being made, the patient is asked to place herself in the knee-chest position to relieve pressure by the presenting part on the umbilical cord against the pelvic bones.

Outcome with different management strategies

Fifty-one cases of cord prolapse were recorded in a 5-year study in Israel (35). Delivery was not imminent and the fetus was still alive. They were managed by filling the bladder with 500 - 700ml of saline and by intravenous ritodrine to diminish the strength of contractions whilst awaiting caesarean section. There were no perinatal deaths in this series. The mean 5 minute Apgar score was 9.5 and only in three cases was it less than 7. No difference was found in the outcome between neonates weighing less than or greater than 2,500g.

In an earlier study, management of 135 cases of cord prolapse seen between 1970 - 1979 was reported (36). The fetus was alive at the time of diagnosis in 127 cases. Of these, 88 cases of cord prolapse, which occurred in the first stage, were managed by rapid instillation of saline into the bladder to relieve cord prolapse during preparation for caesarean section. The overall perinatal mortality rate among cases with a live fetus at diagnosis was 2.4%. In spite of a long diagnosis delivery interval no fetal deaths occurred in 88 cases managed by bladder instillation and caesarean section (36).

In a study on risk factors and infant outcomes associated with cord prolapse, it was found that mortality was less likely to occur among cases delivered by caesarean section (31). Caesarean section gave better results except when the cervix was fully dilated in which case an expedited vaginal delivery could be achieved with a good perinatal outcome (29). Caesarean section is recommended for the intrapartum management of premature breech especially if they are 1,500g or less to prevent the risk of cord prolapse, among other risks (37).

The influence of time from diagnosis to delivery on fetal outcome was reported from a study performed at Hartfield Hospital, Connecticut, USA (38). There were 65 cases of cord prolapse out of 26,545 deliveries from 1988 - 1994. Of these, 48 cases were of frank prolapse and 17 of occult prolapse. Of the 65 cases, 59 were delivered by caesarean section and 6 by vaginal delivery (5 of the vaginal delivery cases were in the occult prolapse group). The mean diagnosis - delivery interval was 20 minutes (range 2 - 77 minutes). None of the neonates with an occult cord prolapse had a 5-minute Apgar score of less than 7, while 9 (19%) of neonates with frank cord prolapse had a 5 minutes Apgar score or less than 7. There were no stillbirths. In the frank prolapse group, there were five cases of neonatal asphyxia, all at a gestational age of >36 and all were delivered by caesarean section at a mean delivery time of 11 minutes (range 5 - 16). It was concluded that umbilical cord prolapse continues to be associated with poor perinatal outcome in some cases despite rapid emergency delivery in a modern, high-risk obstetric unit. The asphyxiated neonates had a shorter than average diagnosis to delivery interval, suggesting that this may not be the only critical determinant of neonatal outcome, particularly with frank cord prolapse (38).

The previously cited study at Tsan Yuk Hospital, Hong Kong, showed that in their series of 70 cases of cord prolapse, the diagnosis - delivery interval was less than 30 minutes in 75% of cases (28). There were 8 perinatal deaths (3 associated with birth weight less than 1000g, 2 stillbirths with cord presentation). The corrected perinatal mortality was 8.6% with a corresponding caesarean section rate of 73.3%. 80% of babies born by caesarean section had 5 minutes Apgar score of 7 or more. It was concluded that early diagnosis of cord prolapse followed by prompt treatment with caesarean, if necessary, were effective in reducing the perinatal mortality rate. However, despite emergency delivery with short delivery intervals,

some studies have shown a continued association of umbilical cord prolapse and poor perinatal outcome (39).

Risk factors and prognosis

There is considerable risk to the fetus after cord prolapse and the perinatal mortality may be high, being lowest where prompt delivery is effected (15). Some factors appear to affect the prognosis. In the series reported from Nigeria, unbooked cases had a perinatal mortality rate of 86.4% compared to an overall 36.7% rate of all cases of cord prolapse (29). A study on antenatal and intrapartum events influencing outcome in very low birthweight infants (less than 1000g) revealed that cord prolapse in infants less than 26 weeks resulted in 100% mortality (39). The mode of delivery did not influence survival.

The neonatal mortality and morbidity associated with preterm breech (62.5% cases were delivered vaginally) in a setting in the Netherlands showed that the corrected neonatal mortality was 13.3%. Preterm vaginal breech delivery was associated with higher mortality than those delivered by caesarean section. The major causes were cord prolapse and entrapment of the fetal head (40). The fetal outcome seems to be worse in frank than in occult cord prolapse.

The mortality and morbidity associated with cord prolapse can be improved by close monitoring during labour for early detection and prompt delivery (38) by bladder instillation with saline to prevent cord compression if delivery is not imminent following diagnosis (35,36) and carefully selecting patients for vaginal delivery to avoid cases at risk of cord prolapse (25). Constant vigilance by attending staff appears to be important. Diagnosis of cord presentation

antenatally (which has the potential to prolapse on rupture of the membranes) has been addressed by using ultrasound (41). Cord presentation was diagnosed antenatally in 9 patients at term referred for fetal ultrasound assessment. 7 patients were delivered by caesarean section with good outcome. Of these, cord presentation was confirmed in 4 and suspected in 3 patients. Two delivered vaginally; one following spontaneous version and the other a stillbirth associated with cord prolapse. The availability of ultrasound may not, however, be readily available in many developing country settings.

Summary

The issues outlined regarding umbilical cord prolapse and its management relates to the incidence, diagnosis, morbidity and mortality, management and, specifically, factors that contribute to prognosis for the infant. Caesarean section is an important (though not exclusive) strategy in the management of cord prolapse.

OBJECTIVES

Broad objectives

1. To characterize and describe the magnitude of caesarean section at UTH in 1998.
2. To review in-depth, factors affecting cord prolapse.

Specific objectives

1. To establish the caesarean section rate at UTH.
2. To enumerate the various maternal, fetal and other characteristics in cases of caesarean section.
3. To determine the indications for caesarean section and factors affecting early fetal and maternal outcome.
4. To assess factors leading to cord prolapse, and, in particular, the role of caesarean section in its management and outcome.

METHODS

This study reviewed all caesarean sections at the University Teaching Hospital, Lusaka, performed from 1st January 1998 to 31st December 1998. In addition, all cases of cord prolapse (whether delivered vaginally or by caesarean section) were reviewed. The study is retrospective and descriptive in design with some analytical components.

Caesarean section

Cases of caesarean section were identified using the Caesarean Section Register kept in the Theatres. The Labour Ward Delivery Register was used to identify any information that was not clearly entered in the Theatre Register. Specific data was collected from patient case files. If this was not available the two Registers provided sufficient core data. There were no questionnaires involved and there was no need to obtain consent from patients.

The following information was obtained for each case:

- Maternal age, parity and gestation
- Indication for caesarean section (more than one recorded, if necessary)
- Rank of medical staff performing the caesarean section
- Type of anaesthesia utilised
- Fetal outcome (alive or stillborn)
- Maternal outcome (maternal mortality)

Regarding maternal mortality, this was crosschecked with the register of maternal deaths in which cases that had a caesarean section had been previously identified.

Cord prolapse

Cases of cord prolapse were identified from entries in the Labour Ward Delivery Register (in which any notable events like cord prolapse are recorded) and the Caesarean Section Register in (Theatre) where the indication of cord prolapse would have been recorded.

The following information was obtained from case files:

- Maternal age, parity and gestation
- Site of cord prolapse (home/urban clinic or UTH)
- How membranes had ruptured leading on to the cord prolapse
- Risk factors contributing to cord prolapse
- Examination findings (fetal presentation/lie, fetal viability, cervical dilatation)
- Mode of delivery
- Diagnosis-to-delivery interval
- Outcome of infant (whether liveborn or stillborn and also the 5 minute Apgar score)

Data Analysis

All the data was entered using Epi Info Version 6 and subjected to descriptive analysis. Data presentation was in tabular form, either as univariates or bivariates (see overleaf) with frequencies and relative frequencies (presented as a percentage). Where relevant, comparative analysis was performed using Chi square and the Odds Ratio. The significance levels were set at 5% ($p < 0.05$).

Data presentation

Univariate (e.g. parity, site, presentation)

Single variable data are tabulated as simple (n) and relative frequency distribution (%).

Variable	n	%
A		
B		
etc		
.		
.		
.		
Total	N	100%

Bivariate (e.g. parity vs mode; or mode vs outcome)

Where there were 2 variables, these are tabulated as exposure columns against outcome rows.

Both absolute numbers and relative frequencies (%) are tabulated. (See example below).

Variable 1 (Exposure) vs Variable 2 (Outcome)

	Exposure		
Outcome	Exposure 1 n (%)	Exposure 2.... n (%)	Total N (%)
Outcome 1			
Outcome2			
.			
.			
.			
Total	n (%)	n (%)	N (%)

Ethical Issues

As this was a retrospective review of data, and no individual persons were identified, there were no ethical issues envisaged or to be considered. However the proposal had been submitted to, and was approved by the University of Zambia Research Ethics Committee.

RESULTS

CAESAREAN SECTION

Caesarean section rate in Lusaka

There were a total of 10,525 deliveries at the University Teaching Hospital in 1998. Of these, 1,880 (17.9%) were delivered by caesarean section giving an institutional caesarean section delivery rate was 17.9%. Records show that there were a total of 33,009 deliveries in the urban maternity clinics in 1998 – a total of 43,534 recorded births in all of Lusaka's public health facilities. All complications are referred to UTH, which is the only place where caesarean sections take place in the public sector. The denominator does not take into account home births, which may not be recorded at any health facility. Similarly it does not take account of any caesarean sections performed in private clinics, although both the total number of deliveries and caesareans at private facilities are believed to be low. The citywide caesarean section rate, then, is estimated at $1,880/43,534 = 4.3\%$. If the unknown number of homebirths that are not recorded were included in the denominator, the citywide rate would be even lower. (Table 1)

Table 1: Caesarean section rate at UTH and in the City of Lusaka, 1998

Facility	Number of deliveries*	Caesarean sections	Percentage	
UTH	10,525	1,880	17.9	Institutional caesarean rate
Other Clinics	33,009	0	0	
All Lusaka facilities**	43,534	1,880	4.3	Lusaka City caesarean rate

*Does not include home births that are not recorded at the health facility

** Excludes private clinics and hospitals

Indications for caesarean sections

A total of 19 distinct indications for caesarean section were identified and tabulated as a key in Table 2. In the case of multiple indications, in conjunction with the supervisor, a ranking was established to determine the primary indication. This was based on practice norms at UTH.

The indications for the 1,880 caesarean sections performed at UTH in 1998 are tabulated in Table 3. Note that they are ranked by frequency and also that some caesarean sections were performed for more than one reason. The most frequent indication was failure to progress in labour (414, 22.0%), followed by previous caesarean section, some of which had other indications as well (363, 19.3%).

See next two pages overleaf

Table 2: Key of indications for caesarean section at UTH in 1998 (n=1880)

Number	Indication
1	Failure to progress in labour (CPD, cervical dystocia, hydrocephalus, deformed pelvis, obstructing pelvic mass, unknown causes).
2	Previous caesarean section
3	Fetal compromise (abnormal CTG) and fetal distress
4	Severe hypertensive disease (pre-eclampsia, impending eclampsia and eclampsia)
5	Malpresentation (excluding breech) and malposition (transverse lie, oblique lie, brow and face presentation, unstable lie, compound presentation, occipito-posterior position)
6	Breech presentation
7	APH (abruptio placentae and placenta praevia)
8	Cord presentation and cord prolapse
9	Multiple pregnancy (including retained second twin)
10	Failed induction of labour
11	Impending uterine rupture (scar tenderness) and ruptured uterus
12	Failed instrumental delivery
13	Others (Huge ovarian mass, cervical cancer, abdominal atresia, sickle cell disease, fibroid uterus, elderly primigravida, fractured hip, diabetes mellitus, genital prolapse, aortic aneurysm, previous VVF)
14	Premature rupture of membranes
15	Grand multiparity
16	Extensive vulvo-vaginal warts
17	IUGR
18	BOH
19	Post dates

Table 3: Indications for caesarean section at UTH in 1998 (n=1,880). Ranked by frequency

Indications*	Number	Percentage	Group** n (%)	
1	410	21.8	414 (22.0)	
1,15	4	0.2		
2	247	13.1	363 (19.3)	
2,1	69	3.7		
2,6	13	0.7		
2,15	13	0.7		
2,14	11	0.6		
2,9	4	0.2		
2,19	4	0.2		
2,18	2	0.1		
3	286	15.2		286 (15.2)
4	167	8.9		167 (8.9)
5	156	8.3	156 (8.3)	
6	129	6.9	129 (6.9)	
7	118	6.3	118 (6.3)	
8	77	4.1	77 (4.1)	
9	41	2.2	49 (2.6)	
9,4	6	0.3		
9,19	2	0.1		
10	41	2.2	41 (2.2)	
11	26	1.4	26 (1.4)	
12	11	0.6	11 (0.6)	
13	12	0.6	12 (0.6)	
14	3	0.2	7 (0.4)	
14,15	3	0.2		
14,18	1	0.1		
15	7	0.4	7 (0.4)	
16	8	0.4	8 (0.4)	
17	4	0.2	4 (0.2)	
18	3	0.2	3 (0.2)	
19	2	0.1	2 (0.1)	
Total	1,880	100	1,880 (100)	

* See Table 2 for key to Indications

** Note that 'Group' includes those within the primary indication, some of which may have had other indications for caesarean section.

Parity of patients undergoing caesarean section

The parity of women on whom caesarean section was performed ranged from 0 to 13. Of these 641 (34.1%) were primiparas, 940 (50.0%) were between parity 1 to 4 and 256 (13.6%) had a parity of 5 or more. In 53 cases (2.8%), the parity was not recorded or was unknown (Table 4).

Table 4.: Parity of patients undergoing caesarean section at UTH in 1998 (n=1880)

Parity	Frequency	Percentage
0	641	34.1
1-4	940	50.0
5 or more	256	13.6
Not recorded/unknown	53	2.8
Total	1,880	100.0

Age of patients undergoing caesarean section

The age distribution ranged from 13 to 45 years. Most of the caesarean sections were performed on women between ages of 20 to 30. However there were a significant number below age 20 and above age 30 years old (Table 5). Note that 29 cases were performed in girls below the age of 15.

Table 5: Ages of patients undergoing caesarean section at UTH in 1998 (n=1,880)

Age	Frequency	Percentage
<15	29	1.5
16-19	344	18.3
20-24	520	27.7
25-29	456	24.3
30-34	288	15.3
35-39	179	9.5
40+	58	3.1
Unknown	6	0.3
Total	1,880	100.0

Parity and indications for caesarean section

Table 6 illustrates the indications against the parity. The commonest indications for the 641 primigravidas having a caesarean section, in order of frequency were: failure to progress in labour (238 cases, 37.1% of all primigravida caesarean sections), fetal distress (142 cases, 22.2%), pre-eclampsia/eclampsia (71 cases, 11.1%) and breech presentation (65 cases, 10.1%).

By way of contrast, previous caesarean section was the commonest indication in those who were multiparous (either as a sole indication or together with another indication- 389, 29.6%). This was followed by failure to progress (in 167 cases this was failure to progress as a single indication, and in another 4 cases together with grandmultiparity; making a total of 171 cases, 14.4%). The third commonest indication in multiparous women was fetal distress (138, 11.6%) (see Table 6 overleaf).

Table 6: Indications for caesarean section and parity at UTH in 1998 (n=1,880)

(*Key in Table 2, page 26) Note percentages total 100% down the columns

Indication (s)*	Parity			Total N (%)
	0 n (%)	1 or more n (%)	Unknown n (%)	
1	238 (37.1)	167 (14.1)	5 (9.4)	410 (21.8)
1,15	0	4 (.3)	0	4 (.2)
2	0	239 (20.2)	8 (15.1)	247 (13.1)
2,9	0	3 (.3)	1 (1.9)	4 (.2)
2,14	0	10 (.8)	1 (1.9)	11 (.6)
2,15	0	11 (.9)	2 (3.8)	13 (.7)
2,1	0	68 (5.7)	1 (1.9)	69 (3.7)
2,19	0	4 (.3)	0	4 (.2)
2,18	0	2 (.2)	0	2 (.1)
2,6	0	12 (1)	1 (1.9)	13 (.7)
3	142 (22.2)	138 (11.6)	6 (11.3)	286 (15.2)
4	71 (11.1)	93 (7.8)	3 (5.7)	167 (8.9)
5	40 (6.2)	112 (9.4)	4 (7.5)	156 (8.3)
6	65 (10.1)	59 (5.0)	5 (9.4)	129 (6.9)
7	19 (3.0)	95 (8)	4 (7.5)	118 (6.3)
8	23 (3.6)	53 (4.5)	1 (1.9)	77 (4.1)
9	10 (1.6)	29 (2.4)	2 (3.8)	41 (2.2)
9,4	1 (.2)	3 (.3)	2 (3.8)	6 (.3)
9,19	0	2 (.2)	0	2 (.1)
10	16 (2.5)	25 (2.1)	0	41 (2.2)
11	0	26 (2.2)	0	26 (1.4)
12	8 (1.2)	3 (.3)	0	11 (.6)
13	3 (.5)	7 (.6)	2 (3.8)	12 (.6)
14	0	3 (.3)	0	3 (.2)
14,15	0	3 (.3)	0	3 (.2)
14,18	0	0	1 (1.9)	1 (.05)
15	0	0	2 (3.8)	7 (.4)
16	4 (.6)	3 (.3)	1 (1.9)	8 (.4)
17	0	3 (.3)	1 (1.9)	4 (.2)
18	0	3 (.3)	0	3 (.2)
19	1 (.2)	1 (.1)	0	2 (.1)
Total	641 (100%)	1,186 (100%)	53 (100%)	1,880 (100%)

Gestation and caesarean sections

The majority of caesarean sections were performed in pregnancies at term, (1198, 63.7%) (Table 7A). A significant number, 168 (8.9%) were performed on pregnancies which were between 29 and 33 weeks gestation. These included 43 performed for severe pre-eclampsia or eclampsia (indication 4) and 26 for APH or abruptio-placentae (indication 7) (see Table 7B). Of the 28 cases less than 28 weeks gestation requiring caesarean section, 8 cases were performed for pre-eclampsia/eclampsia (indication 4) and in 6 cases due to APH (indication 7) (see Table 7B). Other indications for these extremely premature pregnancies included, fetal compromise, malpresentation and retained second twin.

In Table 7C, for illustrative purposes, the indications are consolidated simply as to whether the gestation was preterm (less than 37 weeks) or term.

Table 7A: Gestational age of caesarean sections at UTH in 1998 (n=1,880)

Gestation (weeks)	Frequency	Percentage
<28	28	1.5
29-33	168	8.9
34-36	265	14.1
≥37	1198	63.7
Unknown	221	11.8
Total	1,880	100

Table 7B: Indications for caesarean section and gestational age at UTH in 1998 (n=1,880)

Indication*	Gestational Age (weeks)					Total
	<28	29-33	34-36	>37	Unknown	
1	2	15	46	310	37	410
1,15	0	1	1	2	0	4
2	0	15	29	171	32	247
2,9	0	1	0	2	1	4
2,14	0	1	1	8	1	11
2,15	0	0	3	7	3	13
2,1	1	5	7	46	10	69
2,19	0	0	0	4	0	4
2,18	0	0	0	2	0	2
2,6	0	0	4	9	0	13
3	3	15	31	212	25	286
4	8	43	41	53	22	167
5	3	21	19	93	20	156
6	1	3	22	89	14	129
7	6	26	24	46	16	118
8	1	9	14	46	7	77
9	3	7	8	19	4	41
9,4	0	1	1	2	2	6
9,19	0	0	0	2	0	2
10	0	2	5	30	4	41
11	0	1	4	15	6	26
12	0	0	1	8	2	11
13	0	0	1	6	5	12
14	0	0	2	1	0	3
14,15	0	0	0	2	1	3
14,18	0	0	0	0	1	1
15	0	1	0	2	4	7
16	0	1	1	5	1	8
17	0	0	0	1	3	4
18	0	0	0	3	0	3
19	0	0	0	2	0	2
Total	28	168	265	1,198	221	1,880

*See Table 2 , page 26, for key to Indications

Table 7C. Indications for caesarean section at UTH in 1998 (n=1,880) - Preterm or term

Indication*	Gestation (weeks)						All	
	<37		>37		Unknown			
	N	%	N	%	n	%	n	%
1	63	13.7	310	25.9	37	16.7	410	21.8
1,15	2	0.4	2	0.2	0	0.0	4	0.2
2	44	9.5	171	14.3	32	14.5	247	13.1
2,9	1	0.2	2	0.2	1	0.5	4	0.2
2,14	2	0.4	8	0.7	1	0.5	11	0.6
2,15	3	0.7	7	0.6	3	1.4	13	0.7
2,1	13	2.8	46	3.8	10	4.5	69	3.7
2,19	0	0.0	4	0.3	0	0.0	4	0.2
2,18	0	0.0	2	0.2	0	0.0	2	0.1
2,6	4	0.9	9	0.8	0	0.0	13	0.7
3	49	10.6	212	17.7	25	11.3	286	15.2
4	92	20.0	53	4.4	22	10.0	167	8.9
5	53	11.5	93	7.8	20	9.0	156	8.3
6	26	5.6	89	7.4	14	6.3	129	6.9
7	56	12.1	46	3.8	16	7.2	118	6.3
8	24	5.2	46	3.8	7	3.2	77	4.1
9	18	3.9	19	1.6	4	1.8	41	2.2
9,4	2	0.4	2	0.2	2	0.9	6	0.3
9,19	0	0.0	2	0.2	0	0.0	2	0.1
10	7	1.5	30	2.5	4	1.8	41	2.2
11	5	1.1	15	1.3	6	2.7	26	1.4
12	1	0.2	8	0.7	2	0.9	11	0.6
13	1	0.2	6	0.5	5	2.3	12	0.6
14	2	0.4	1	0.1	0	0.0	3	0.2
14,15	0	0.0	2	0.2	1	0.5	3	0.2
14,18	1	0.2	0	0.0	1	0.5	1	0.1
15	2	0.4	2	0.2	4	1.8	7	0.4
16	0	0.0	5	0.4	1	0.5	8	0.4
17	0	0.0	1	0.1	3	1.4	4	0.2
18	0	0.0	3	0.3	0	0.0	3	0.2
19	0	0.0	2	0.2	0	0.0	2	0.1
Total	461	100.0	1,198	100.0	221	100.0	1,880	100.0

*See Table 2, page 26, for key to Indications

Rank of medical staff performing caesarean sections

Caesarean sections were mainly performed by Registrars (1,179 of the 1,880; 62.7%) and Senior Resident Medical Officers (SRMOs) (489, 26%) (Table 8). Only 188 (10%) and 24 (1.3%) were performed by Senior Registrars and Consultants, respectively.

Table 8: Rank of medical staff performing caesarean sections at UTH in 1998 (n=1,880)

Surgeon	Frequency	Percentage
SRMO	489	26
Registrar	1179	62.7
Senior registrar	188	10
Consultant	24	1.3
Total	1880	100.0

Type of anaesthesia and caesarean section

Nearly all caesarean sections were performed under general anaesthesia except for 5 (0.3%) which were performed under spinal anaesthesia (Table 9).

Table 9: Type of anaesthesia, (all caesareans, UTH 1998, n=1,880)

Anaesthesia	Frequency	Percentage
General anaesthesia	1,875	99.7
Spinal anaesthesia	5	0.3
Total	1,880	100.0

Fetal outcome after caesarean section

1,987 neonates were delivered from the 1,880 caesarean sections. These included 1,775 singletons, 103 sets of twins and 2 sets of triplets. 1,868 (94%) of the fetuses were alive at delivery after caesarean section while in 119 cases (6%) the fetus was stillborn (Table 10). It was not possible to collect early neonatal or neonatal deaths from this retrospective exercise.

**Table 10: Fetal outcome after caesarean section at UTH in 1998
(n=1,880 caesarean sections; 1,987 fetuses)**

Outcome	Frequency	Percentage
Alive	1,848	93.0
Stillborn	139	7.0
Total	1,987	100.0

Indications for caesarean section and fetal outcome

139 of the 1,987 fetuses were stillborn at caesarean section (7% of all babies delivered). It was not possible to collect data reliably regarding whether the fetus was alive just before the caesarean was performed. Tabulated in Table 11, ranked by numbers and as a percent case fatality for each indication, the 139 stillborn included 23 cases after ruptured uterus (out of 26 cases – case fatality of 88.5%), 20 after APH (out of 125, 16% case fatality), 21 after malpresentation (12.6% case fatality), but only 9 (3.1% case fatality) in which fetal distress had been an indication and 17 (of 425, 4% case fatality) in which failure to progress had been an indication. It could be argued that in the case of a ruptured uterus, this was not the same as a caesarean section as it is primarily a laparotomy. The fetal case fatality is not unexpectedly high.

Table 11: Indications for caesarean section and fetal outcome (n=1,880 caesareans, 1,987 fetuses)

Indication(s)*	Fetal outcome			
	Alive (n)	Stillborn (n)	Total (N)	Case Fatality by Indication (%)
1	404	17	421	4.0
1,15	4	0	4	0.0
2	249	5	254	2.0
2,9	4	0	4	0.0
2,14	11	0	11	0.0
2,15	14	0	14	0.0
2,1	68	1	69	1.4
2,19	4	0	4	0.0
2,18	2	0	2	0.0
2,6	14	0	14	0.0
3	283	9	292	3.1
4	166	5	171	2.9
5	144	21	165	12.7
6	143	4	147	2.7
7	105	20	125	16.0
8	77	8	85	9.4
9	57	3	60	5.0
9,4	12	0	12	0.0
9,19	4	0	4	0.0
10	39	2	41	4.9
11	3	23	26	88.5
12	12	0	12	0.0
13	12	1	13	7.7
14	6	0	6	0.0
14,15	3	0	3	0.0
14,18	1	0	1	0.0
15	10	0	10	0.0
16	8	0	8	0.0
17	4	0	4	0.0
18	3	0	3	0.0
19	2	0	2	0.0
Total	1,848	139	1,987	7.0
(*See Table 2, page 26, for key to Indications)				

Fetal outcome and rank of surgeon

The Senior Resident Medical Officers (SRMOs) had the lowest rate of stillborn after caesarean section (19 out of 521, 3.6%) with the Consultants having the highest (4 out of 28, 14.3%) – see % stillborn. However most stillbirths occurred when Registrars operated (90 case, 64.7% of all stillborn) (Table 12).

**Table 12: Fetal outcome in relation to rank of operating surgeon
(All fetuses at caesarean, UTH, 1998, n =1,987)**

Surgeon	Fetal Outcome			
	Stillborn n (%)	Alive n (%)	Total N (%)	% Stillborn
SRMO	19 (13.7)	502 (27.2)	521 (26.2)	3.6
Registrar	90 (64.7)	1,144 (61.9)	1,234 (62.1)	7.2
Senior registrar	26 (18.7)	178 (9.6)	204 (10.3)	12.8
Consultant	4 (2.9)	24 (1.3)	28 (1.4)	14.3
Total	139 (100)	1,848 (100)	1,987 (100)	7.0

In order to compare fetal outcome (alive or stillborn) by rank of surgeon, the junior surgeons (SRMOs and Registrars) were grouped together as were the Senior Registrars and Consultants, giving the following contingency table:

	Stillborn	Alive	Total
SR/Consultant	30	202	232
SRMO/Registrar	109	1,646	1,755
Total	139	1,848	1,987

Odds ratio 2.24 (95% CI: 1.43<OR<3.51), p<0.0002

This implies that seniors were 2.24 times more likely to have a caesarean section complicated by a stillbirth than were juniors.

Fetal outcome and gestational age

Table 13 illustrates that with decreasing gestational age, the immediate fetal outcome was poorer at caesarean section (19.4% of stillborn at caesarean section occurred in cases where the gestational age was less than 28 weeks and 13.9% for cases between 29 and 33 weeks gestation).

**Table 13: Relation between gestation age and fetal outcome
(All Caesareans, UTH, 1998, n=1,987)**

Gestational Age Gestation (weeks)	Fetal Outcome		Total	% Stillborn
	Stillborn	Alive		
<28	6 (4.3)	25 (1.4)	31 (1.6)	19.4
29-33	25 (18.0)	155 (8.4)	180 (9.1)	13.9
34-36	23 (16.5)	273 (14.8)	296 (14.9)	7.8
>37	55 (39.6)	1,194 (64.6)	1,249 (62.9)	4.4
Unknown	30 (21.6)	201 (10.9)	231 (11.6)	13.0
Total	139 (100)	1,848 (100)	1,987 (100)	7.0

In order to compare fetal outcome (alive or stillborn) by gestation, the caesarean sections were grouped by preterm or term (less than or greater than 37 weeks) and presented in the contingency table below.

	Stillborn	Alive	Total
Preterm (<37 weeks)	54	453	507
Term (>37 weeks)	55	1,194	1,249
Total	109	1,647	1,756*

Those with missing gestation are omitted from the analysis*.

Odds ratio 2.59 (95% CI: 1.72<OR<3.89), p<0.0001

A caesarean performed on a preterm was 2.59 times more likely to have a stillbirth as an outcome compared to caesarean section performed on term pregnancies.

Maternal case fatality of caesarean sections in 1998

Seven cases of maternal mortality were identified of the 1,880 caesarean sections performed in 1998 representing a case fatality of 3.7 per 1,000 caesarean sections. These are summarized in Table 14 and a brief description of each case is presented overleaf.

Table 14: Summary of cases of maternal mortality following caesarean section

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age (years)	26	27	19	37	25	22	19
Gravidity Parity	G4P3	G4P3	G1P0	G3P1+1	G5P1+1	G2P1	G1P0
Gestation (weeks)	39	37	38	33	37	38	34
Anaesthetic	GA	GA	GA	GA	GA	GA	GA
Surgeon	Registrar	SRMO	Registrar	Registrar	Registrar	Registrar	Registrar
Indication	APH Placenta praevia	2 previous CS	Eclampsia	Severe pre- eclampsia	Pre- eclampsia Twins	Eclampsia	Chorio- amniitis
Emergency/ Elective	Em	Em	Em	Em	Em	Em	Em
Plurality	singleton	singleton	Singleton	singleton	twin	singleton	singleton
Infant outcome	stillborn	Apgar score 9	Apgar score 9	AS 4	Recorded as both well	Recorded as well	Apgar score 2
Maternal Problem	DIC	Infection, Bowel perforation on relaparotomy	Pneumonia in puerper ?Pulmonary TB	Collapse	PPH DIC	Comatose	Septic shock
CS to death	<24hrs	56d	28d	4 hrs	8days	4 days	<24hrs

Case 1. A 26-year-old, gravida 4 para 3, no relevant past obstetric history, presented at 39 weeks gestation with antepartum haemorrhage. Placenta praevia was suspected and a Registrar performed an emergency caesarean section under general anaesthesia. At caesarean section there was a stillborn and placenta praevia was confirmed. The patient was noted to have disseminated intravascular coagulation soon after the operation and died within 4 hours of the caesarean.

Case 2. A 27 year old, gravida 4 para 3, having had a caesarean section ten years previously (child alive), a vaginal delivery of a preterm infant 5 years ago (neonatal death) and a subsequent caesarean section 4 years previously (infant death at 2 months) was admitted in labour at 37 weeks gestation. An emergency caesarean section was performed by an SRMO using a pfannenstiel incision. A liveborn infant with good weight and Apgars was born. The patient developed a pelvic abscess and subsequently underwent laparotomy. A fresh perforation of the bowel was noted after separation of adhesions. The patient died 56 days after caesarean section.

Case 3. A nineteen-year-old in her first pregnancy underwent caesarean delivery at just over 38 weeks gestation because of eclampsia. A Registrar performed the caesarean and general anaesthesia was utilised. A singleton infant was born in good condition. The patient was noted to be chronically ill and died at day 28 with pneumonia – tuberculosis had been suspected. No HIV testing had been performed.

Case 4. A 37-year-old, gravida 3 para 1, (previous normal vaginal delivery at term, followed by a miscarriage) required delivery by caesarean section because of severe pre-eclampsia at 33 weeks gestation. A Registrar performed the caesarean and general anaesthesia was utilised. A liveborn infant with a poor Apgar score was delivered. The patient collapsed within 4 hours of caesarean. At the relatives' request a postmortem was not performed.

Case 5. A 25-year-old in her fifth pregnancy was diagnosed with twins and pre-eclampsia at 37 weeks gestation. Delivery was by caesarean section performed by a Registrar, with both

infants well at birth. The patient subsequently had postpartum haemorrhage, developed disseminated intravascular coagulation and died on the eighth day post-caesarean section.

Case 6. A 22-year-old in her second pregnancy underwent emergency caesarean section at 38 weeks after eclampsia. A Registrar performed the caesarean and general anaesthesia was utilised. Infant condition was good. However the patient remained comatose and died after 4 days.

Case 7. A nineteen-year-old in her first pregnancy failed to go into labour after prelabour rupture of membranes preterm. A Registrar performed the caesarean and general anaesthesia was utilised. The infant was born in poor condition (Apgar score of 2 at 5 minutes). The patient developed septic shock post-caesarean and died within 24 hours.

DISCUSSION

CAESAREAN SECTION

Incidence

Out of the 10,525 total deliveries at the UTH in 1998, 1,880 were delivered by caesarean section giving an institutional caesarean section rate of 17.9%. The UTH rate had been 14.2% in 1995, reducing to 10.3% in 1996 and increasing to 15.3% in 1997. The trend appears to be on the increase at UTH (see below). As the number of deliveries at UTH has decreased, the number of deliveries in the District clinics has increased (not tabulated). A study of referral patterns and type of conditions in the particular years would need to be undertaken to understand fully the trends.

Year	Number of caesarean sections	Number of deliveries at UTH	Institutional caesarean section rate (%)
1995	1,868	13,185	14.2
1996	1,348	13,065	10.3
1997	1,621	10,563	15.3
1998	1,880	10,525	17.9

By contrast, the institutional caesarean section rate was 8% at an Ethiopian hospital in 1993 (14) and 14.8% at a district hospital in Poland in 1993 (8). However, the range of caesarean section rates can be extremely variable from place to place and from obstetrician to obstetrician. In Italy for example there was a cited obstetrician range of 0-53% (5).

The institutional rate at UTH of 17.9% for 1998 should be seen in the context of the citywide rate, considering UTH is the referral level for all citywide deliveries. The citywide rate was 4.3% (Table 1, page 24). WHO advocates that the minimum acceptable population caesarean section rate is 5% and a maximum of 15% (42). According to that indicator, the rate for

Lusaka is slightly on the lower side indicating that there may be some caesarean sections that ought to be performed but are not for any number of reasons. The important consideration is whether the perinatal mortality would be improved as a result of performing more caesarean sections without increased morbidity and mortality of mothers.

The WHO indicator with an upper limit of 15% refers to a population (i.e. all deliveries in the area) and does not refer to the institutional rate. Accordingly, it is difficult to say whether the institutional rate of caesarean section at UTH for 1998 is too high, appropriate or low without a comprehensive audit of each case. Mention will be made of possible causes below. It would be important to evaluate the trend of caesarean section rates over the years to be able to ascertain increasing trends, factors that may contribute to changes in these rates at the UTH and to institute firm intervention policies in order to alter these rates. Although advances in surgical and anaesthetic techniques, safe blood transfusion and effective antibiotics have reduced maternal mortality associated with caesarean section, from 75% in 1870 to 1-8/1000 currently, high caesarean section rates are a source of concern because of related complications e.g. anaesthetic complications, haemorrhage, infection and other long-term complications (3,14,16, 19).

INDICATIONS

The commonest indications for performing caesarean section at UTH as shown in Table 3 were: failure to progress (22%), previous caesarean section (19.3%), fetal distress or fetal compromise (15.2%), severe hypertensive disease (8.9%), malpresentation and malposition (8.3%) breech presentation (5.5%), APH (6.3%) and cord accidents (4.1%). These eight indications, between them, accounted for 89.6% of all indications. The results are not very

dissimilar to those reported from around the world. For example, in the Netherlands, dystocia, repeat caesarean section, breech presentation and fetal distress were commonest (1). A study from Ethiopia compares well where CPD, malpresentation and malposition, repeat caesarean section, APH and fetal distress accounted for 95% of all indications (14). However, in both studies quoted above, hypertensive disease and cord accidents did not feature as prominent indications for caesarean section as they do in this study done at UTH.

Failure to progress

The commonest indication for caesarean section at UTH was failure to progress in labour for various reasons (414 cases, 22.0%), predominantly due to presumptive cephalopelvic disproportion (CPD). Like in any other African country, CPD remains a common indication for caesarean section at UTH. However, there are milder to moderate degrees of CPD where caesarean section can be avoided using timely and judicious use of oxytocin augmentation. By so doing, infection morbidity with caesarean section can be avoided especially in situations where fetal membranes have been long ruptured or many digital vaginal examinations have been performed (20). In these cases of milder CPD, particularly if detected in the second stage of labour, symphysiotomy in experienced hands or other forms of assisted vaginal delivery have been cited by others to not only reduce the caesarean section rate, but also reduce maternal morbidity and mortality without compromising fetal outcome (7). It might be worthwhile to review this long forgotten procedure of symphysiotomy at UTH in selected cases and evaluate how maternal and fetal outcomes compare with those after caesarean section.

Some doctors possibly resort to caesarean section because of inexperience in the use of

assisted instrumental delivery devices when they may be indicated in selected cases. Training medical officers the skills needed for instrumental delivery can decrease difficult abdominal deliveries of babies in the second stage of labour. The training would need to reinforce the judgement on when to safely embark on instrumental delivery and also on the prerequisite technical skills.

Previous caesarean section

There were 363 (19.3%) caesarean sections for the indication of previous caesarean section in 1998 at UTH (Table 3) and was the second commonest indication. This was slightly higher than the 16%, which were found in Ethiopia in 1992 (14). Women with a previous uterine caesarean scar could be safely allowed a trial of vaginal delivery in a controlled setting. The practice at UTH has been to select women with only one previous caesarean section for trial of vaginal delivery. In Zimbabwe, where 281 women with one or more previous caesarean section were compared with 4,051 women without a scar, only one of the 124 women allowed to have trial of scar had a uterine rupture (25). The conclusion was that it seemed rational to encourage a trial of labour after one or more caesarean section. Similarly, a recent study at UTH of outcome after previous caesarean section showed that almost 50% achieved a vaginal delivery. This figure rose to over 70% in those who had already had one vaginal delivery after a previous caesarean section (43). Ruptured uterus had occurred in those who were unbooked.

Anecdotally, a number of women with 2 previous caesarean sections admitted to the labour ward at UTH already in the second stage of labour have proceeded to deliver without complications. Nevertheless the risk of rupture of the uterus remains. It would appear that

very careful selection and close monitoring of women including those with 2 previous caesarean sections could enable some women to deliver vaginally and caesarean section avoided.

Fetal Distress

Fetal distress (including cases of abnormal CTG) was the third commonest indication for caesarean section (286 cases, 15.2%). There were 9 caesarean sections with fetal distress as the indication where the resultant Apgar Score was 0. These caesarean sections were all performed by SRMO's with the hope of delivering live babies. It is questioned whether there was fetal viability or that the fetus was already dead before caesarean section began. On the other hand, there were caesarean sections performed for fetal distress based on fetal heart rate characteristics using either the Pinard stethoscope or CTG, that resulted in delivery of a babies with good Apgar scores of 8 and above at 5 minutes (see later for Indications and Case fatalities). As reviewed in the literature, use of electronic fetal heart monitoring tends to increase cesarean section rates (13) and this has led to the recommendation that caesarean section for improperly diagnosed fetal distress should be avoided (1). The addition of fetal scalp pH evaluation to fetal heart rate monitoring can avoid unnecessary caesarean sections (26). However this is not available at UTH and is not recommended for areas of high prevalence of HIV because of the potential for mother-to-child transmission in such cases.

Hypertensive disorders of pregnancy

Severe hypertensive disease (severe pre-eclampsia, impending eclampsia, eclampsia) was the fourth commonest indication for caesarean section (167 cases, 8.9%). This appears to be region specific. In the study of indications for caesarean section from Ethiopia at Jimma

Hospital, hypertensive disease did not feature prominently (14). Until a few years ago, eclampsia at UTH in the antenatal or early intrapartum period had been managed by immediate caesarean section such that junior doctors rushed these patients to the operation theatre, sometimes even before senior input could be sought. It is now accepted practice to stabilise these patients while aiming for vaginal birth, where possible, particularly if the eclamptic fits are under control and the fetal wellbeing is satisfactory.

Abnormal lie and fetal malpresentation

The fifth commonest indication for caesarean section was abnormal lie and fetal malpresentation (other than breech presentation). This included transverse, oblique and unstable lie, and brow and face presentation. Before the advent of antibiotics, surgeons resorted to destructive methods to deliver dead fetuses where spontaneous vaginal birth was impossible with abnormal lie. Caesarean section has now become the safer method of delivering such babies because intrauterine fetal destruction can lead to extensive maternal morbidity. In selected cases, external cephalic version (ECV) or stabilising induction is tried to achieve a vaginal delivery. In cases of face presentation (if mento-anterior) and those with compound presentation (if premature), vaginal delivery may be possible. Persistent occipito-posterior position can cause undue anxiety, especially to inexperienced obstetricians and midwifery attendants, because it leads to prolonged labour and in the presence of fetal wellbeing may require augmentation with oxytocic drugs and a longer time in labour for successful vaginal delivery. Therefore, not all women with such complications require caesarean delivery.

Breech

Breech presentation was the sixth commonest indication for caesarean section and had been listed as a separate category because of its management dilemma. They contributed 6.9% (129 of 1,880) of caesarean sections performed. A further 13 cases were in women who had a previous caesarean which had been cited as the primary indication. The variation of caesarean section rates for breech presentation is wide from obstetrician to obstetrician. Some advocate that every breech presentation has to be delivered by caesarean section, especially so in primigravidae. In Tasmania, the incidence of primary caesarean section increased due to an increase in caesarean section for breech presentation and fetal distress (7). However, this increase was without a corresponding fall in perinatal mortality illustrating that in their environment, other factors needed to be considered for the optimal management of both breech presentation and fetal distress.

External cephalic version (ECV) of the breech is infrequently practiced at UTH and probably needs to be revisited. Almost 70% of versions were successfully achieved in one study resulting in a 30% caesarean section rate for breech compared with 75% when version was not attempted (22). It was estimated that an active programme of ECV could reduce the expected 3 - 4% breech presentation rate at delivery by about half (23).

Antepartum haemorrhage (APH)

In this study APH was the seventh commonest indication for caesarean section, being either due to placenta praevia or abruptio placenta, though in some cases no cause could be detected. It is established practice to allow placenta praevia type 1 and 2 anterior to deliver vaginally while type 2 posterior, and types 3 and 4 are best delivered abdominally. Similarly in Ethiopia,

APH was the fourth commonest indication after CPD, malpresentation and repeat caesarean section (14). In an emergency, and also without ultrasound facilities, examination in theatre (EIT) is currently used to diagnose or exclude placenta praevia at UTH. On performing a vaginal examination, the experience of the examining doctor to feel for the 'bogginess' of placental tissue in the vaginal fornices plays a major role. Thus, an uncertain doctor may decide to proceed with caesarean section even when it is not actually placenta praevia. It should be recommended that all cases of 'Examination in Theatre' for suspected placenta praevia be done by more experienced doctors, preferably of the rank Registrar and above. Although the threshold for caesarean section is low as far as placenta praevia is concerned, it is not so with abruptio placenta, in which the majority of women deliver vaginally and quickly, minimising the possibility of unnecessary caesarean sections. Furthermore, the risks and consequences of disseminated intravascular coagulation and the fact that the fetus would be dead in many cases prevents junior doctors from performing caesarean section in cases of abruptio placenta without the decision of a senior doctor.

Cord presentation and cord prolapse

The eighth commonest indication for caesarean section was cord presentation and prolapse. There were 3 cases of cord prolapse where the umbilical cord was thought to be pulsating but at delivery, the babies were stillborn. These were all performed by SRMO's. A junior doctor may have mistaken maternal pulsations for fetal bradycardia. It is probably the reason why caesarean section was performed on dead fetuses. More detail is discussed under the separate section on cord prolapse.

Failed induction

Regarding failed induction of labour leading to caesarean section (2.2% of indications); it is noted that labour was mainly induced by oxytocin or extra-amniotic insertion of a Foley's catheter to ripen the cervix before rupture of membranes. With the availability of the prostaglandin analogue, misoprostol, at UTH, the incidence of failed induction of labour seems to have reduced but it would require another study to confirm this fact

Other indications

Other indications worth mentioning in relation to caesarean section in 1998 are the 41 (2.2%) for multiple pregnancy (as a single separate indication), 7 (0.4%) for grandmultiparity (as a single separate indication), 3 (0.2%) for premature rupture of membranes (PROM), and 2 (0.1%) for postdates. These are not usually indications of caesarean section by themselves. One of the 41 cases of multiple pregnancy patients 9 had cord prolapse affecting twin one while in 2 cases there were triplets. Although another reason had not been cited for the rest, it is believed that other indications would have contributed to the decision to perform a caesarean section in these cases. There were a total of 27 cases in which grandmultiparity and related indications for caesarean section were cited (in 7 cases as a sole indication). 13 of these were associated with previous caesarean section, 4 failed to progress, while 3 had associated PROM. The reasons for caesarean section in the remaining 7 grandmultiparas was not indicated (could probably have been failure to progress or failing to go in labour after rupture of membranes). The case files were not useful in helping come to a conclusion. Grandmultiparity by itself is not usually an indication for caesarean section. Cases with PROM, and postdates had no other obvious reason for caesarean section determined. Complications such as previous caesarean section, hypertension, failure to progress, fetal

compromise, malpresentations, BOH or other complication would justify all these caesarean sections. In addition, there may have been reluctance to induce grandmultiparas with oxytocin due to fear of rupture of uterus.

Other possible reasons to consider for caesarean sections is that more couples are getting more familiar with health education and their rights in Zambia. Increased incidence of litigation may be a contributor to the caesarean section as is noted in USA (12). It would be interesting to study whether this has any bearing on caesarean section rates in Zambia.

Effect of parity

The parities of women who underwent caesarean section ranged from 0 to 13 and as illustrated in Table 4 (page 28) 34.1% of all caesarean sections were in primiparas, 50.0% in the intermediate group and 13.6% in those with parity greater than 4. The comparable rates of vaginal deliveries are not available to compare with. Nevertheless, the extremes of childbearing age (between age's 16-21 and 40-44 years age) are associated with high caesarean section rates (11). It would not be surprising therefore to find that the rate of caesarean section is higher in primiparas than in those with higher parity. As part of a regular audit for the maternity service in Lusaka, it would be useful to have information for comparison purposes regarding the caesarean section versus vaginal delivery rates for women with different parities.

Effect of age

There was a wide distribution of ages represented in those who had a caesarean section (Table 5, page 28). This is related to parity. As discussed above for parity, without a distribution of

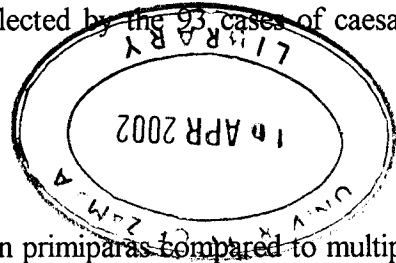
ages of all women who had delivered in Lusaka in 1998, it is not possible to comment on the different age groups represented.

Parity and indications

As illustrated in Table 6 (page 30), the commonest indications for caesarean section of those who had been primiparas were failure to progress, mainly as a result of CPD, followed by fetal distress, severe hypertensive disease and breech presentation, representing 37.1%, 22.2%, 11.1% and 10.1% respectively of caesarean sections in that group. In multiparous women, by contrast, the commonest indications were previous caesarean section, failure to progress mainly due to unknown causes, fetal distress, and malpresentation other than breech presentation and APH (29.4%, 14.4%, 11.6%, 9.4% and 8% respectively). It is noteworthy that a significant number of multiparas underwent caesarean for failure to progress (167 cases or 14.4% of all multiparas who had a caesarean section) despite previously having delivered vaginally. Cephalopelvic disproportion can occur for the first time in later pregnancies e.g. due to increasing birthweight. In any case, having ruled out other causes of CPD, caution is exercised in the use of oxytocin in augmenting labour in these multiparous cases because of the risk of rupture of the uterus.

The higher incidence of CPD in primiparas compared to multiparas (37.1% of all caesarean sections in this group vs 14.4% in multiparas) is associated with an 'untried pelvis' in the primiparas. Fetal distress as an indication for caesarean section was probably commoner in primiparas in association with more prolonged labour and oxytocin augmentation, in comparison with multiparous women in whom labour is generally shorter (Table 6, page 30).

Primiparas are known to have a higher incidence of severe hypertensive disease compared to multiparous women. As expected hypertensive disease featured as a cause for caesarean section more often in those who had been primiparas (11.1%, rank third among primiparas) compared to multiparas (7.8% ranked sixth among multiparas). Nevertheless it is still an important indication in those who are multiparas as reflected by the 93 cases of caesarean section in that group.



The high caesarean section rate for breech presentation in primiparas compared to multiparas (65, 10.1% compared to 59, 5.0%) is likely due to the policy of being more conservative in primiparas compared to multiparas regarding allowing a trial of vaginal delivery.

The incidence of caesarean section for malpresentation is more in multiparous women compared to primiparas (112, 9.4% compared to 40, 6.2%). This may be a reflection of a lax abdominal wall and tendency to abnormal lie in multiparas compared to primiparas.

Gestation and caesarean section

Table 7A (page 31) shows that gestation was unknown in 11.8% cases of caesarean section (221 of the 1880 cases). This is not unexpected as many women may not have known for certain the date of their last menstrual period. However, 63.7% were in term pregnancies and 23.5% in preterm pregnancies. It is noteworthy that 28 (1.5%) of the caesarean sections were in pregnancies less than 28 weeks gestation but these were mainly for indications of severe pre-eclampsia and APH. These are plausible due to the extreme prematurity rendering induction difficult and also due to the extreme emergency in some cases of APH, in both cases necessitating immediate or early delivery for maternal indications.



Below 28 weeks gestation survival rates are low in the neonatal intensive care unit at the UTH, perhaps leading obstetricians to avoid performing caesarean section under these circumstances. This is contrary to the situation in developed countries where more caesarean sections are being performed at this gestation to improve survival of the grossly premature infant (3). At UTH, caesarean section at this low gestation appears to be done mainly for maternal compromise. However, in 3 cases the indication was fetal compromise. Consideration of the local neonatal survival rates and consent of a well-counseled woman are important under these circumstances.

In general there were more caesarean sections at term compared to preterm when the indication was for failure to progress (26.1% vs 14.1%) or for fetal compromise (17.7% vs 10.6%) (see Table 7C – page 33). By contrast it was the other way round in hypertensive disease (20% in preterm compared to 4.4% in term) and antepartum haemorrhage (12.1% in preterm vs 3.8% at term). In the former – this may have been contributed by the fact that it becomes more difficult to induce at an earlier gestation.

Rank of surgeon

The majority of caesarean sections at UTH are performed by Registrars (year 2 and 3 postgraduate students of the 4 year programme) accounting for 62.7% of all caesarean sections, followed by SRMO's (26.0%) and the remaining 10.0% by Senior Registrars (including year 4 postgraduate students) and 1.3% by Consultants (Table 8). This is more a reflection of the larger numbers of Registrars and SRMOs and also their longer 'on call' commitments.

It was not possible to determine the seniority of the doctor who makes the decision for caesarean section, although at UTH it is expected that this should be at least at Registrar level.

Anaesthesia and caesarean section

There seems to be very little choice as to the type of anaesthesia for various indications or circumstances at UTH. As reported in Table 9 (page 34), 99.7% caesarean sections were performed under general anaesthesia with only 5 cases (0.3%) performed under spinal anaesthesia. One of the reasons why high caesarean section rates are a source of concern include anaesthetic complications (3,14), especially with the use of general anaesthesia. Complications like chest infection and aspiration could be reduced by the use of regional anaesthesia. Regional anaesthesia has not been practiced routinely at UTH mainly for logistical reasons (unavailability of local anaesthetic e.g. bupivacaine). Most of the anaesthetists are conversant with the technique and have been trained accordingly. The advantage of regional anaesthesia, apart from the fact that it is cost effective, is that it is suitable for most indications of caesarean section, apart from a few cases e.g. hypovolaemic shock due to APH, and would reduce the maternal and perinatal morbidity and mortality associated with the use of general anaesthesia. Regional anaesthesia is particularly advantageous in pre-eclampsia (having excluded DIC or a low platelet count), as it tends to slightly reduce blood pressure. There is need to recommend that facilities and training are put in place for caesarean sections to be performed under regional anaesthesia at UTH.

Fetal outcome after caesarean section

Taking into consideration multiple pregnancies, there were 1,987 babies born from the 1,880 caesarean section deliveries (Table 10, page 35). Of these 1,848 (93%) infants were alive at

birth and 139 (7.0%) were stillborn. The fetal case fatality at caesarean section by indication is illustrated in Table 11 (page 36). Excluding cases of ruptured uterus, the fetal case fatality rate was greatest in caesarean section performed for APH (16.0%) followed by malpresentation (12.7%). It is noted that the data did not allow for early neonatal deaths and neonatal deaths or neonatal morbidity.

In at least 12 cases that resulted in a stillborn outcome, emergency caesarean section was performed to try and salvage live fetuses e.g. those affected by cord prolapse (in 3 cases) or fetal distress (in 9 cases). In other cases, the caesarean section was performed for maternal indications (e.g. in cases of previous caesarean, malpresentation, APH) regardless of whether the fetus was alive or not. Nevertheless the 139 (7.0%) represent a large number of cases of caesarean section performed with a stillborn outcome. In some cases it is probable that the diagnosis of intrauterine death may have been missed or that severely distressed fetuses died between the time of diagnosis and delivery. This needs to be further explored and reasons elucidated. A Pinard stethoscope to diagnose fetal distress may not always be adequate. Consideration must be made to provide more sensitive electronic devices to detect fetal cardiac activity in the operation theatre such as the Sonicaid or ultrasound machine to prevent performing a caesarean section when the fetus was already dead – in which case, in certain circumstances, a vaginal delivery could be attempted. In some cases of failure to progress, a longer interval of labour could be allowed for a woman who has an intrauterine death and may need more oxytocin to achieve vaginal delivery (if there were no risks for rupture of the uterus).

Previously, obstetricians resorted to destructive methods when a vaginal delivery could not be

achieved and the fetus was dead. Now with the advent of antibiotics, caesarean section is safer and often preferable leading to a few cases of caesarean section performed in known cases of intrauterine death.

The high fatality rate in fetuses delivered from women who had a caesarean section for APH is noteworthy. Most of these were cases of placenta praevia or abruptio with life threatening vaginal bleeding. Also, although the fetal outcome of a stillbirth at caesarean section after failure to progress was only 4.0% of all caesareans for that indication, the 17 cases contributed a high number of cases of all fetuses that were stillborn. Strategies to reduce these deaths could include constant review of the partogramme to enable a timely decision for caesarean section to be made and also to constantly appraise the amount of oxytocin being infused to prevent uterine hyperstimulation and subsequent fetal distress.

Fetal case fatality and rank of surgeon

The fetal case fatality at caesarean section in relation to the rank of the operating surgeon had been presented in Table 12 (page 37). The impression is that the fetal case fatality rate at caesarean section is higher for senior doctors because they perform most of the complicated caesarean section. The odd ratio of 2.24 of a stillbirth associated with a senior doctor operating indicates that the risk was over twice that of juniors. When senior staff performed caesarean sections, the indications could potentially lead to a high case fatality rate, for example APH, ruptured uterus, transverse lie in labour, and severe hypertensive disease in the preterm. In these cases the fetus may already have been dead preoperatively or the operation may have been technically difficult.

Fetal outcome at caesarean by gestation

The fetal outcome in premature babies requiring caesarean section was poor. (Table 13, page 38). There was a case fatality rate of 19.4% in those less than 28 weeks gestation and 13.9% between 29 and 33 weeks compared with 4.4% at term (>37). It is noted that 201 infants had an unknown gestation and of these 30 were stillborn (13.0%).

Nevertheless, excluding the cases with missing gestation from analysis, prematurity (<37 weeks) was 2.59 times more likely to be associated with stillbirth at caesarean section than a term infant born by caesarean section was. This poor outcome with prematurity may be as a result of the effects of labour on the premature infant as well as effects of other complications such as hypertension before caesarean section. Although the literature suggests that caesarean section delivery may be safer for the infant in grossly premature infants, especially if breech (3,40), survival rates at the neonatal intensive care unit at UTH discourage obstetricians from performing caesarean section. Even if these babies are born alive, a number of them die in the early neonatal period in the neonatal unit. Nevertheless, some of these caesarean sections are performed in the interest of the mother and others for the baby's sake. It is therefore advisable to conduct a study to see if it is worthwhile to perform caesarean section for fetal interests especially at a gestation below 28 weeks by following up these babies.

Again from Table 13 it is noted that the majority (39.6%) of stillborn were term fetuses, even though they had the smallest case fatality (4.4%). This is accounted for by the fact that most caesareans were performed at term – they are more in absolute numbers but markedly less as a proportion.

Caesarean section and maternal case fatality

The maternal case fatality for caesarean section at UTH in 1998 was 3.7 per 1,000 cases (7 cases out of 1,880 caesareans performed). This is less than a case fatality rate of 5.7 per 1,000 reported in India in 1995 (17). A study in Ethiopia noted the case fatality after caesarean to be 11 per 1,000 case (44).

Eclampsia and pre-eclampsia were noted to be implicated in 4 cases (although in Case 3 tabulated in Table 14, page 39, death was subsequent to respiratory tract infection in the postnatal period and thought to be due to tuberculosis). The increased problems of maternal death and eclampsia have been highlighted in South Africa as well (45). In a further two cases at UTH, the patient had lost a substantial amount of blood (antenatally and postpartum at caesarean). Although not documented at UTH, a number of cases of HIV positive patients undergo caesarean and such patients may have an increased morbidity and subsequent mortality (18). One case of chorioamnionitis died with septic shock highlighting the problem of caesarean section and sepsis (20).

It is recognised that there is a finite case fatality associated with caesarean section and adequate preparation pre-operatively and operative and postoperative care should be taken in the management of such cases. All cases in this study were performed as an emergency, under general anaesthesia, by Registrars and SRMOs. In order to be able to reduce the case fatality, strategies include good anaesthetic management, availability of blood, antibiotic prophylaxis and also operation by trained surgeons. Registrars are considered experienced in managing most complications of caesarean section but they should also have access to senior support in a timely manner when required.

Complications after caesarean section.

This study, by virtue of its retrospective nature, did not set out to assess the extent of short and long-term maternal complications associated with caesarean section (apart from death). As described in the Literature Review this is a major problem. Infectious morbidity, especially, is believed to be high and would warrant a study in its own right to assess steps that could be taken to reduce such morbidity.