""EVALUATION OF STILLBIRTH AND EARLY NEONATAL DEATH BY VERBAL AND PATHOLOGICAL AUTOPSY AND THEIR CORRELATION - A HOSPITAL BASED ONE YEAR DESCRIPTIVE STUDY"

By

Dr. SRIVIDHYA

Dissertation submitted to the
KLE University, Belgaum, Karnataka

In Partial Fulfillment
of the requirements for the degree of

M. S.
(OBSTETRICS AND GYNAECOLOGY)

Under the Guidance of

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MAY - 2010

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DECLARATION

I hereby declare that this dissertation entitled **"EVALUATION OF STILLBIRTH AND EARLY NEONATAL DEATH BY VERBAL AND PATHOLOGICAL AUTOPSY AND THEIR CORRELATION - A HOSPITAL BASED ONE YEAR DESCRIPTIVE STUDY"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. M. B. BELLAD** $_{\textbf{MD}}$ Professor, Department of Obstetrics and Gynaecology, Jawaharlal Nehru Medical College, Nehru Nagar, Belgaum – 590 010.

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I am grateful to **Dr. V. D. Patil** MD, DCH Principal, J. N. Medical College, Belgaum, and **Dr. M. V. Jali** MD Chief Executive, for permitting me to utilize the facilities at the Medical College and at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum to carry out the present study.

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LIST OF ABBREVIATIONS USED

ANC	–	Antenatal care
CNS	–	Central nervous system
CSF	–	Cerebrospinal fluid
CVS	–	Cardiovascular system
END	–	Early neonatal death
FSB	–	Fresh stillbirths
GIT	–	Gastrointestinal system
IUD	–	Intrauterine Death
IUGR	–	Intrauterine growth restriction
MSB	–	Macerated stillbirths
NFHS	–	National family health service
NICU	–	Neonatal intensive care unit
NPV	–	Negative predictive value
NST	–	Non stress test
PA	–	Pathological autopsy
PIH	–	Pregnancy induced hypertension
PMR	–	Perinatal mortality rate
PPV	–	Positive predictive value
RS	–	Respiratory system
SGA	–	Small for Gestational Age
USG	–	Ultrasonography
VA	–	Verbal autopsy
WHO	–	World Health Organization

ABSTRACT

Background and objectives

Globally eight million deaths occur every year. In India perinatal mortality rate is 49/1000 births. Vital registration comprising cause of death is available only in less than three percent of all perinatal deaths. Verbal autopsy is cost effective, time saving method to assign the cause of deaths. The objectives of the present study were to determine cause of death in stillbirth and early neonatal death using verbal and pathological autopsy and its correlation.

Methodology

The present descriptive observational study was conducted at Teaching Hospital attached to Jawaharlal Nehru Medical College, Belgaum during the period of December 2007 to May 2009. Perinatal deaths meeting the selection criteria prospectively for 18 months were selected for the study. Validated verbal autopsy questionnaire with additional information was provided to women / relative with stillbirth/early neonatal death (END), skilled birth attendant and neonatologist. Pathological autopsy without immunohistochemical and chromosomal tests were done.

Results

There were 3904 deliveries and 193 perinatal deaths were recorded in the study period. Among them 168 were stillbirths and 25 were ENDs. Among them, 110 stillbirths and three ENDs met selection criteria and included in the study as most of stillbirths cases agreed for pathological autopsy than END. Among 110 stillbirths, 76 were fresh stillbirths and 34 were macerated stillbirths. Perinatal

mortality rate was 49.4 per 1000 births. The principle cause of perinatal deaths were abruption (29%), placenta previa (5%), preeclampsia (17.2%), congenital anomalies (5.4%) and unknown (20.9%) by verbal autopsy. On pathological autopsy, placental pathology (41%) and congenital malformation (5.4%) were the principle causes of perinatal death. Six additional congenital anomalies were detected. Verbal autopsy has a high sensitivity and negative predictive value.

Conclusions and interpretation

Verbal autopsy is simple, cost effective and reliable tool in evaluating perinatal mortality in developing countries with limited resources.

Key words Perinatal death; Perinatal mortality; Stillbirth; Verbal autopsy.

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INTRODUCTION

"To loose an offspring is hard and harder still to loose by a disease not fully understood. But for the sake of other children; I think that to have seen his or her organs is of greatest utility".[1] - Lester King 1

Perinatal mortality is the most sensitive index of efficacy of not only antenatal, intranatal care and quality of child health but also of socioeconomic condition of the community.[2] Perinatal death complicates about 1.5% of all births in developed countries.[3] Pregnancy failure is often difficult for parents and their families to understand and may provoke criticism of the physician.[3]

Perinatal mortality rate (PMR) is late fetal death (more than or equal to 28 weeks gestation) and early neonatal death (within seven days of birth) in one year to total number of live births in the same year.[4] It is expressed as rate per 1000 live births.[4] The current PMR in India is 49 per 1000 births as per the NFHS 3.[5]

Still births account for large number of perinatal deaths.[6] Still births have been understudied, under reported and rarely considered in attempts to improve adverse pregnancy outcomes in developing countries.[7]

A systematic review on the incidence of still births by World Health Organization (WHO) in 2002, concluded that incidence of stillbirth in most settings was around one to two percent of the total number of births.[7] About 55% of studies registered, definition for still birth and the limit between miscarriage and still births varied from 20 weeks of gestation (United Kingdom) to 28 weeks of gestation (India).[7]

Primary obstetric causes of perinatal death include spontaneous preterm delivery and hypertensive disorders.[8] Antepartum hemorrhage, multiple pregnancy, intrapartum asphyxia and maternal disease contribute to remaining cases.[8] Preterm birth, sepsis, birth asphyxia and congenital malformation are the main causes of deaths in newborn babies worldwide. [8]

The National Birthday Trust of Great Britain carried out its first perinatal survey in which all the births during one week in March 1958, were studied in detail and postmortem were performed on 90% of all perinatal deaths.[9] This survey showed that a high proportion of those deaths were due to asphyxia associated with maternal pre eclampsia or prolonged pregnancy or combination of both,and showed its serious implication on fetus.[9] Perinatal deaths from these causes are almost entirely preventable by good antenatal care, combined with good facilities for delivery and resuscitation.[9]

Autopsy means “to see for oneself” and it is the scientific approach to the evaluation of the nature and the extent of the disease and the cause of death.[10] Verbal autopsy has been used for research and planning purposes since 1930s. The term “Verbal autopsy” was first proposed by Arnold Keilman, although the first detailed and thorough application was in 1990.[10]

Verbal autopsy is a cost effective, time saving method to assign the cause of death where vital registration system is weak and pathological autopsy is not easily acceptable. It is a technique, based on an interview with primary caregiver.[10] The cause of death derived from verbal autopsy is increasingly used for health planning, priority setting in countries with incomplete or no vital

registration system.[11] Verbal autopsy comprise of questionnaire for deriving at the cause of death. [11]

Pathological autopsy of fetus is the most valuable test in evaluation of cause of death in still births and early neonatal death.[12] Perinatal autopsy can provide an explanation for a loss and may reveal a specific disorder for which precise recurrence risks or strategies for prevention are available.[13]

This study helps to determine the cause of stillbirth and early neonatal death based on the information on maternal health and complication during pregnancy and labour and also by pathological autopsy. Thus helps in prevention of still births and early neonatal death and to improve the perinatal outcome.

OBJECTIVES

Primary Objective:

To determine the cause of death in still birth and early neonatal death using verbal and pathological autopsy.

Secondary Objective:

To correlate the findings of verbal and pathological autopsy.

REVIEW OF LITERATURE

Perinatal mortality is the most sensitive indicator of maternal and child health care. Perinatal mortality in developing countries is three to five fold higher compared to developed countries.[2-4] The current perinatal mortality rate in India is 49 per 1000 live births.[5] Stillbirth rate in Belgaum is 21 per 1000 births.[6] Stillbirths generally account for one half of all perinatal deaths, with an estimated four million occurring worldwide each year.[6] More than 97% of these stillbirths take place in developing countries.[4] Stillbirths have been understudied, under reported and rarely have been considered in attempts to improve adverse pregnancy outcomes in developing countries.[2-6]

Although the WHO has attempted to standardize the definition of stillbirth by recommending 1000 gm as the lower limit for international comparisons (corresponding approximately 28 weeks of gestation).[6] The lower limit of gestational age or birth weight varied widely.[6] In developed countries, stillbirth has been defined as fetal loss beyond 20 weeks of gestation, however some developed countries (such as Sweden) still use 28 weeks of gestation as the lower cut-off. In developing countries, gestational age of 28 weeks or birth weight of 1000 grams is often the lower cut-off that is used.[6]

The timing of still birth in relation to delivery also varies. The stillbirths that occur more than 12 to 24 hours before delivery have skin that is macerated and those stillbirths that occur in intrapartum period or immediately before delivery are called fresh stillbirths.[7] When intrapartum stillbirths occur, they represent inadequate access to or poor quality of essential obstestric care.[7]

Much is still unknown about the prevalence, timing and circumstance that are associated with stillbirths in developing countries, where one half of all deliveries occur at home.[11] Since data on stillbirths are not collected routinely in many countries, most of the stillbirth research is hospital based.[11] Therefore understanding the burden of stillbirth has an important implication on health planning and resources, which are of particular concern in very low resource countries.[6]

The common primary obstetric causes of perinatal death include spontaneous preterm delivery (28.7%) and hypertensive disorders (26.3%).[8] Other causes are antepartum haemorrhage, multiple pregnancy, intrapartum asphyxia, fetal abnormality and maternal diseases.[2,8] Preterm birth (30%), sepsis (27%), birth asphyxia (23%) and congenital malformations (6%) are the main cause of deaths in newborn babies worldwide.[14,17]

Antepartum stillbirths occur due to combination of severe maternal, placental or fetal abnormalities.[2,7] It includes umbilical cord complications, severe pre-eclampsia, severe inuterine growth restriction, abruptio placentae and infections.[2,7] There are various recognized risk factors for antepartum stillbirths like advanced maternal age, high parity, maternal smoking and obesity.[7]

Intrapartum fetal death is usually result of fetal distress and, or obstructed labour and often reflects poor access or poor quality of clinical care during delivery.[2] In developed countries, the majority of stillbirths occur before labour onset,but this proportion is low in developing countries may be due to under reporting of cases.[2,7]

Pregnancy induced hypertension is responsible for high perinatal loss. [2,5,8] The leading cause of preventable antepartum stillbirth was suboptimally managed maternal hypertension.[5] Hypertensive women have an increased risk of stillbirth because of uteroplacental insufficiency but also there is ten fold risk of placental abruption.[2,5,8] The preeclampsia though not preventable condition, can be well controlled by good antenatal care, timely induction of labour and careful monitoring of fetal heart sounds during labour.[15]

Antepartum haemorrhage accounts for around 12 to 17% of fresh still births.[16] Placental abruption is the single most identifiable cause of fetal death.[2,5] Abruption was found to be the cause of death in 14% of stillborns.[2,5,8] About 10% of third trimester stillbirths are the consequences of premature separation of placenta.[16] In placenta praevia, preterm delivery is a major cause of perinatal death.[16] The congenital anomalies are increased with placenta praevia.[16]

Prematurity is the single most important cause of death in early neonatal period.[8,17] In developed countries where intensive neonatal care is available, only very premature babies are at risk of death.[8] Prematurity, however has a devastating effect in developing countries where mortality is high even at late gestational age.[8] Spontaneous preterm delivery contributed to 28.7% of perinatal death.[2,8] Prematurity was leading cause of still birth in 19.3% and 26% accounted for early neonatal deaths.[4]

Antepartum haemorrhage (19.3%), prematurity(13.24%), severe anaemia (10.92%) and severe preeclampsia (8.36%) were the important causes of perinatal mortality.[2,5] Important causes of death in preterm babies were perinatal hypoxia,

hyaline membrane disease, infections, intraventricular haemorrhage and pulmonary haemorrhage.[2,14,17]

Women who are diabetic have increased risk for stillbirths. In women with gestational diabetes mellitus, the stillbirth rate is 6.5 per 1000 live births.[18] In women with pre gestational diabetes mellitus, stillbirth rate is 25 per 1000 live births.[18] In diabetic patients, perinatal mortality is increased due to congenital anomalies, respiratory distress with prematurity and intrauterine hypoxia.[18,19] The pathophysiology of stillbirth in diabetes mellitus attributed to uncontrolled hyperglycemia of mother leading to fetal hyperglycaemia associated with accumulation of fetal lactic acid, further leading to anaerobic metabolism with consequent hypoxia and acidosis. Increased rate of stillbirth is noted despite an intensive fetal surveillance program.[18,19]

Perinatal mortality due to diabetes mellitus is 10.5%.[19] Even with modern obstetric care and diabetes management, stillbirth rates in women with type 2 diabetes mellitus reported to be 2.5 fold higher than non diabetic women.[19,20]

Birth asphyxia is a common cause of perinatal death. [2,5,17] Hypoxia is thought to be the factor in 90% of intrapartum death and much of the reduction is contributed to continuous fetal monitoring.[21] A mature fetus dying during child birth is usually defined as preventable death.[17,21] Intrapartum stillbirth could be avoided with better obstetric care in 25-62%.[21] Birth asphyxia contributes to 26% of global stillbirths and 23% of global neonatal death. [5,21]

Multiple pregnancies constituted approximately three percent of all births, but 10% of all stillbirths.[5,20] Intra uterine fetal death is 1.8% in twin, 2.4% in

triplet and 3.7% in quadruplet fetus.[20] Stillbirth rate among singleton pregnancy is approximately 0.5%. [2,5,20] The cause of death in multiple gestation are for less clear than in singleton pregnancies.[20] However, fetal growth restriction, abruption, pre-eclampsia, anomalies and cord accidents, are all more common in multiple gestation and are likely etiology of fetal death.[20] Stillbirth rate is higher in monochorionic multiple gestation due to superficial and deep placental vascular anastomoses.[20]

Intra-uterine growth restriction represents major risk factor for perinatal death.[2,3,5] The range of small for gestational age babies, in live births is about 10 to 25% and in stillbirths, rising upto 41%.[3] Stillbirth babies were 6.8 times more likely to be small for gestational age (SGA). Antenatal surveillance including Doppler velocimetry is useful in distinguishing small for gestational age fetus at risk for fetal death. [3,12] Absent end diastolic velocity or reverse flow in the umbilical artery is suggestive of severe fetal compromise and should prompt consideration of delivery.[12]

Neonates with intrauterine growth restriction has increased morbidity due to necrotizing enterocolitis and thrombocytopenia.[17,20] Although 25% of women had additional risk factors like maternal hypertension.[20] The identification and appropriate management of growth restricted fetus helps in prevention of stillbirth.[17,20]

Genetic abnormality is present in approximately six to 12% of stillbirths.[2,3,5] The proportion of chromosomal abnormalities is higher in stillbirths with structural malformations.[2,5,20] Fetuses with congenital

abnormalities incompatible with fetal growth and development are often aborted in early gestation.[21] Congenital abnormalities of gastrointestinal tract like tracheo-oesophageal fistula or lungs like pulmonary hypoplasia become life threatening after birth.[3,22] Congenital anomalies caused 45.8% of early neonatal death (END) and 9.4% of stillbirths.[22] In stillbirths, 17.1% were due to severe anomalies without any correlation with gestational age.[1,3] 9.4% of stillbirth due to congenital anomalies malformations such as anencephaly, hydrocephaly or other neural tube defects like meningomyelocele which are incompatible with life have been the subject of intensive study.[1,3,5]

Umbilical cord accidents like true knots, nuchal cords or cord compression attributes to significant proportion of stillbirths.[20] Nine percent of stillbirths were attributed to cord accidents.[1,2,5,20] However upto 30% of normal pregnancies are complicated by true knots in the umbilical cord and are often detected in association with liveborn infants.[20,24] The clinicopathological classification was hypoxia – placental insufficiency and hypoxia – cord accidents.[24] Hypoxia due to cord accidents is defined as nuchal cord more than or equal to two or true knot or prolapse.[24] The incidence of cord prolapse is about one in 300 deliveries.[24] The perinatal mortality is about 50% due to acute placental insufficiency.[3,20]

Infections account for 10 to 25% of fetal death in developed countries.[3,20] Stillbirth is associated with bacterial, protozoal and viral infections. Infection causes stillbirth by number of mechanisms like direct infection, placenta damage and severe maternal illness.[20] Nineteen percent of fetal deaths less than 28 weeks

associated with infection whereas only two percent of term stillbirths were infection related.[1,20]

Fetomaternal haemorrhage has been associated with three to 14% of all stillbirths.[7,8,12] It leads to fetal anaemia and hypoxia which is considered as the cause of death.[12]

A fetal death that is unexplained by fetal, placental, maternal or obstetric factors is the most frequent type of fetal demise (25 to 60%).[2,5,23] It is a diagnosis of exclusion and depends on the rigorousness of assessment of stillbirth.[5,23]

Neonatal mortality rate in India is 43 per 1000 live births.[14] Globally important and direct cause of death are preterm birth (28%), sepsis (36%), pneumonia (26%), asphyxia (23%), congenital anomalies (7%) and diarrhea (3%).[14,17] Three quarters of neonatal deaths occurs in the first week of life.[14] Maternal complications in labour carry a high risk of neonatal death.[8,14,17] The cause of early neonatal death were perinatal hypoxia (43%), infection (16%), congenital anomalies (15%), intraventricular haemorrhage (5.6%) and no cause (5.4%).[17]

Low birth weight babies constitute about 60 to 80% of neonatal deaths. It may be due to preterm, in-utero growth restriction or both.[2,8,14,17] Low birth weight constituted 36% of early neonatal death.[4,17]

Maximum number of stillbirths were low birth weight that is 78.12%.[5] Among the individual birth weight categories: 1001 to 1500 gm (40%), 1501 to 2000 gm (12.5%), 2001 to 2500 gm (13.54%), less than 1000 gm (20%) and

more than 2500 gm (20.8%).[1,5,17] The association of birth weight and perinatal mortality showed that as birth weight increased, perinatal mortality rate decreased.[1,2,5,17]

When stillbirths were split into various gestational age categories, maximum number of stillbirth were seen in 28 to 33 weeks gestation (42.7%) and least in more than 37 weeks (4.16%). [1,2,5] 70.8% of stillbirths were preterm and 3.1% were due to post maturity.[25-27]

Autopsy means "To see for oneself".[1] It is a scientific approach to the evaluation of the nature and the extent of the disease and the cause of death.[1]

Verbal autopsy is a cost effective, time saving method to assign the cause of death where vital registration system is weak.[10] The cause of death derived from verbal autopsy are increasingly used for health planning and priority setting in countries with incomplete registration system.[11] Verbal autopsies are interviews with care givers to establish cause of death.[10] It consists of a questionnaire adopted by an expert panel.[11] Verbal autopsy starts with an open ended questions to elicit a narrative about perinatal death followed by close ended questions.[28-32]

The cause of death during infancy and stillbirth by verbal autopsy showed the sensitivity and specificity of 85.6% and 99.4% respectively.[33] The cause of perinatal death showed the specificity and sensitivity of verbal autopsy to be 100% and 61% respectively.[34]

Verbal autopsy method is feasible and helpful to study the cause of death, especially for deaths occurring at home in our country, if the field staff is adequately trained.[4,28-32]

Pathological autopsy of the fetus is the most valuable test in evaluation of cause of death in stillbirths and early neonatal death.[12] Its importance should be emphasized to family.[12] The special expertise of pathologist in perinatal medicine and a consultation with geneticist in useful with methodical gross and microscopic examination of the fetus and the placenta at delivery.[35,36] However, despite careful examination of the fetus and placenta at autopsy, failure to determine specific cause of death still occurs in as many as 25% of fetal losses.[36,42] There is a gradual fall in autopsy rates in recent years and the factors contributing to it are community attitudes, clinicians reluctance to request autopsy, hospital concern about legal action and finding priorities.[35-42]

The cause of perinatal death by pathological autopsy was determined in 94% of the cases.[13] The cause of stillbirth by pathological autopsy were placental or umbilical cord pathology (61%), congenital malformation (17%), unexplained death (15%), infections (2%) and others (2.6%).[1,3]

The perinatal autopsy is valuable in three ways that is, confirmation of antemortem diagnosis, identification of unexpected disorders and exclusion of other conditions that might have caused intrauterine death (IUD).[3,43]

Autopsy is performed on the guidelines of Royal College of Pathology. It includes;

1. Thorough external examination for dysmorphic features / congenital malformation / deformities / maceration / gestational age.
2. Internal examination includes systemic description of major organs.
3. Placenta, membranes and umbilical cord.
4. Histology.
5. Special procedures and investigations like X-ray, bacteriology and virology, karyotype, biochemical and haematological examination, if indicated.[44]

Perinatal outcome in a given population is determined by several biosocial, environmental, obstetric and neonatal factors.[44,46] The female literacy, socio-economic status, age, parity, prenatal care and previous stillbirth are the risk factors associated with perinatal deaths.[46] Women who are of advanced maternal age are at higher risk of still birth throughout gestation.[27,45-47] Women of 35 to 39 years, had two fold increase and women of 40 years had 2.4 fold increase in rate of still birth compared to women younger than 30 years old.[47]

Nulliparous women were consistently at higher risk of stillbirths, compared with multiparous women in every maternal age group.[45-47] Lack of prenatal care, women belonging to low socio-economic status and mother who is illiterate are at high risk of perinatal death.[2,4,45-47] Universal antenatal care, early detection of obstetric problems, timely referral to higher centre and immediate effective attention to high risk cases would help in reducing perinatal mortality.[2,4,27] Detection of causative factors of stillbirths helps the obstetrician both in terms of fetal care and counseling the affected couple.[27]

METHODOLOGY

The present study was conducted in the Department of Obstetrics and Gynaecology, Jawaharlal Nehru Medical College, Belgaum during the period of Dedember-2007 to May-2009.

Study design

Descriptive Observational Study

Study period

The present study was conducted during the period of December 2007 to May 2009.

Sample size

The present study consisted of 113 cases.

Sampling procedure

All the women with stillbirth or early neonatal death, who delivered in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum during the study period were included.

Selection criteria

Inclusion criteria

- Women with still birth or early neonatal death who delivered in KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum.
- Women willing to provide informed consent for verbal and fetal autopsy.

Exclusion criteria

- Neonatal death occurring outside the hospital.
- Maternal death.

Method of data collection

Ethical Clearance

The ethical clearance was obtained from Review Board of Jawaharlal Nehru Medical College, Belgaum. (Letter No.2304, dated 22/11/2007)

Informed Consent

All the women with stillbirth or early neonatal death during period were screened for eligibility. Written informed consent was obtained in the presence of witness from the woman who fulfilled the inclusion criteria. The informed consent was read out and explained in their vernacular language and their questions were answered. It was also explained that lack of participation will not affect the usual and anticipated standard of care .The women were enrolled in the study only after taking their signature or left hand thumb impression on informed

consent form (Annexure I). Adequate time was provided for describing the study and fielding questions from the patient and/or immediate family members. Subject ID was a assigned to those women who consented for the study.

Photograph 1: Consent for participation in the study

Data collection form:

- The data collection was completed for all women enrolled into the study. Screening form consisting of demographic details was completed.

- Validated verbal autopsy questionnaire was completed by the birth attendant and women or relative with still birth or early neonatal death and neonatologist in case of early neonatal death. Information regarding interviewer name and date of interview was collected, and;

- Symptoms concerning mother.
- Events during the birth of the child.
- Symptoms concerning newborn (One to Seven days).
- Regarding still births.

- Additional information on the other contributory factors leading to still birth and early neonatal death was collected for all cases enrolled in the study.
    - Information regarding present pregnancy (Gestational age, parity, singleton or multiple, ultrasonography, presence of preeclampsia or eclampsia on admission).
    - Information about previous pregnancy.
    - Information on labour (Spontaneous or induced, vaginal or cesarean section, outcome of delivery).
    - Information regarding still birth – Fresh or macerated.
    - Information on early neonatal death (Requirement of NICU care, ventilatory support, medication, breast feeding of baby).

- Fetus and placenta in case of still birth and baby in case of END sent for autopsy for all cases enrolled in the study.

- Fetus and the placenta sent to pathology department after injecting 10% formalin into abdominal cavity, thorax (right and left side) and brain. Stored in 10% formalin.

- In pathology department, autopsy was performed by the same pathologist, on the guidelines of Royal College of Pathology, except for special procedures and investigations like bacteriology (blood / lung / CSF), virology, karyotyping, biochemistry and serological tests.

  - **External examination**

    - Body weight.
    - Hear circumference.
    - Crown lump length
    - Apparent gestation
    - Maceration
    - Meconium staining
    - Demographic features, congenital malformation and deformities.
    - Other abnormalities (like edema).

  - **Internal examination**

    - Comment on cranial thoracic and abdominal cavities.
    - Systematic description of major organs and tissues.
    - Weights of all major organs in digital balance.

  - **Placenta**

    - Weight
    - Umbilical cord – Length, vessels, abnormalities.
    - Membranes – Complete, incomplete, colour, abnormalities, fetal, maternal and cut surface.

- **Histology**
    - Atleast one block of all major thoracic and abdominal organs (Right and left lungs, heart, liver, kidneys, adrenals).
    - Adequate sampling of brain (One block from hind brain and one from hemispheres).
    - Adequate sampling of placenta (Cord, membranes, focal lesions, grossly normal parenchyma.

The cause of death of stillbirth and early neonatal death was assigned by verbal autopsy by a single investigator. The factors contributing to the cause of perinatal deaths were noted. The cause of perinatal death was assigned by pathological autopsy and its correlation with verbal autopsy was noted.

The subject ID assigned to the enrolled participants, identified all the data. All data pertaining to the enrolled participants including sociodemographic data, obstetric history, intrapartum, postpartum details, stillbirths, neonatal period in early neonatal deaths were recorded in the data collection instrument. The data was transmitted to the compiler where it was placed in excel database. All data were backed up on CD.

Statistical analysis

SPSS 13 software was used for analyzing the study data. The data obtained was tabulated and analysed using rates, ratios and percentages. The sensitivity, specificity, positive predictive value and negative predictive value were calculated for verbal autopsy.

RESULTS

During the study period, there were 3904 deliveries and 193 perinatal deaths. All 193 perinatal deaths were screened. Out of them, 168 were stillbirths and 25 were early neonatal deaths. The data obtained was tabulated and analysed using SPSS 13.

Incidence of perinatal mortality

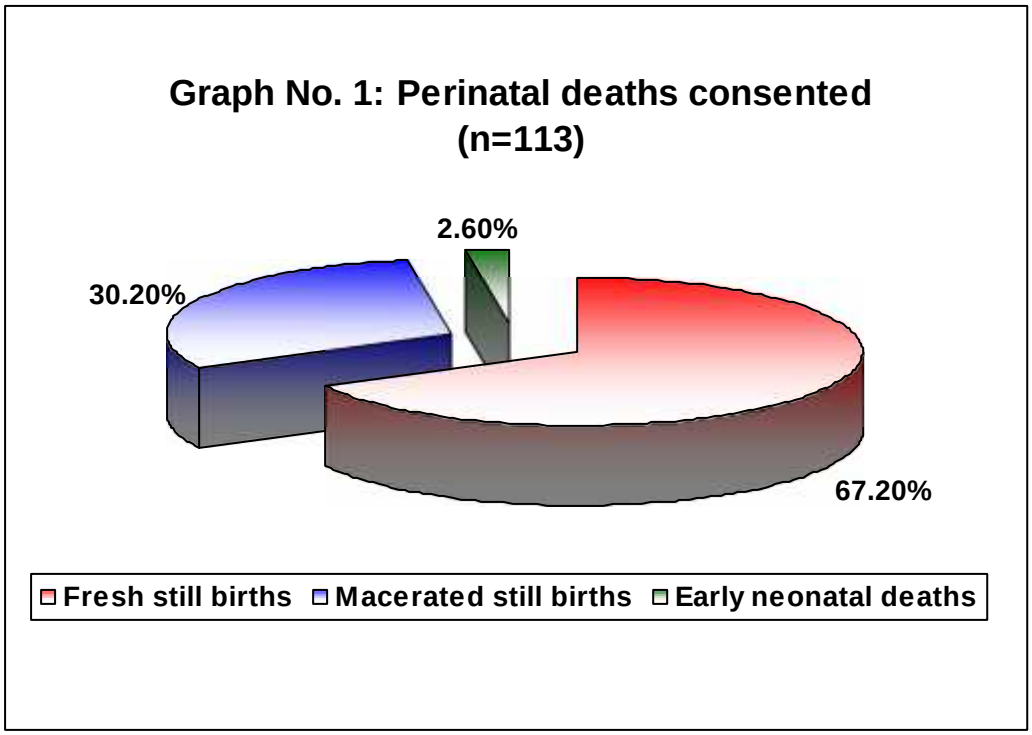
Table 1: Incidence of perinatal mortality

Number of deliveries		3904
Registration	Registered	2891
	Unregistered	1013
Perinatal deaths	Unregistered	123
	Registered	70
	Total	193
Stillbirths		168
Early Neonatal deaths		25
Perinatal Mortality rate		49.4/1000 births
Stillbirth rate		43/1000 births

In the present study, Perinatal Mortality rate was 49.4/1000 births.

Table 2: Perinatal deaths consented

		Total	Registered	Unregistered
Total number of perinatal deaths consented		113	24	89
Stillbirths	Fresh still birth	76 (67.2%)	16	60
	Macerated stillbirths	34 (30.2%)	6	28
	Total	110	22	88
Early neonatal deaths		03 (2.6%)	2	1

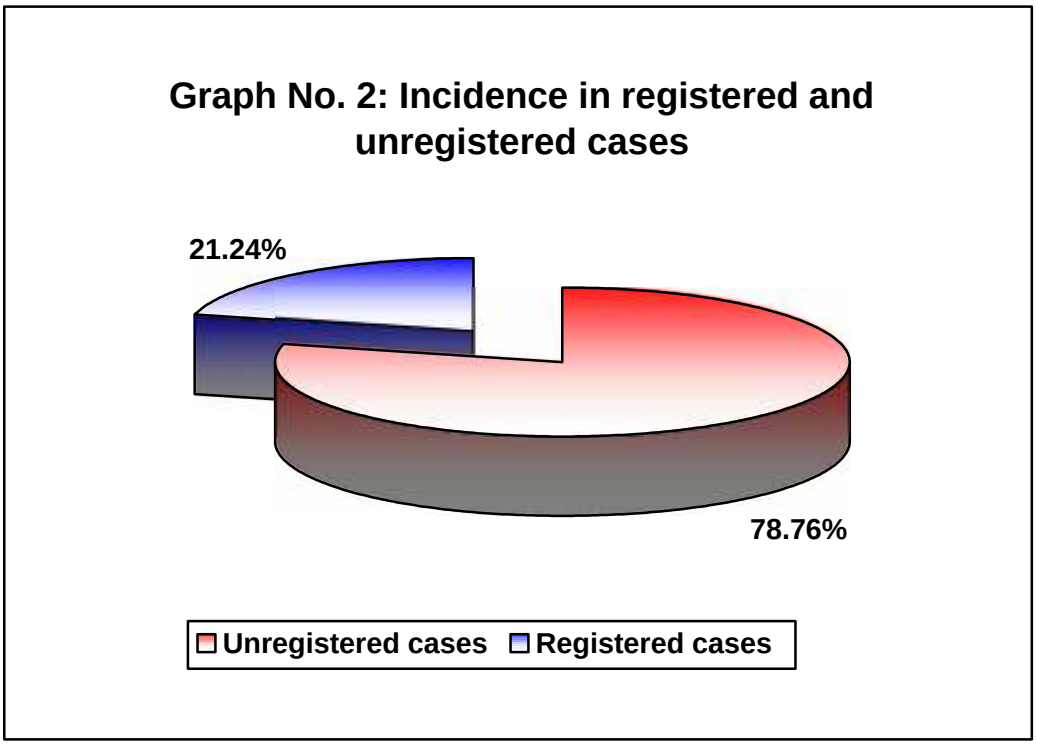


In the present study, though all perinatal deaths(193) were screened, of which 113(58.5%) consented. The reason for not participating in the study was mainly lack of willingness for pathological autopsy in 41.5% due to ritual/ religious reasons, specially so in case of early neonatal deaths. Out of 113

perinatal deaths, there were 110 stillbirths and three early neonatal deaths. Out of 110 stillbirths, 76(67.2%) were fresh stillbirths and 34(30.2%) were macerated stillbirths

Table 3: Incidence in registered and unregistered cases

Registration	Total (n = 110)	Percentage
Unregistered	88	78.76%
Registered	22	21.24%



Stillbirths were more common in unregistered cases (78.76%) than registered (21%) (Table 3).

Table 4: ANC visit in registered cases

Last ANC visit	Total (n = 22)
>4 wks	15
1 – 4 wks	5
Within 7 days	4

Among the registered case, maximum number of women with stillbirths had their antenatal (ANC) visit more than 4 weeks back. Among the 22 registered stillbirths, 7 were registered in the institute where the study was conducted and 15 cases were registered outside. Among the registered cases, cause of stillbirths were due to abruption (11), severe preeclampsia (10),preterm (16), severe IUGR (4), congenital anomalies (2), undetermined (2), eclampsia(1), cord prolapsed (1), birth asphyxia (1) and placenta previa (1). Stillbirths were seen even in those women who had their ANC within 7 days due to placenta praevia(1), abruption(2) and congenital anomaly diagnosed on USG.

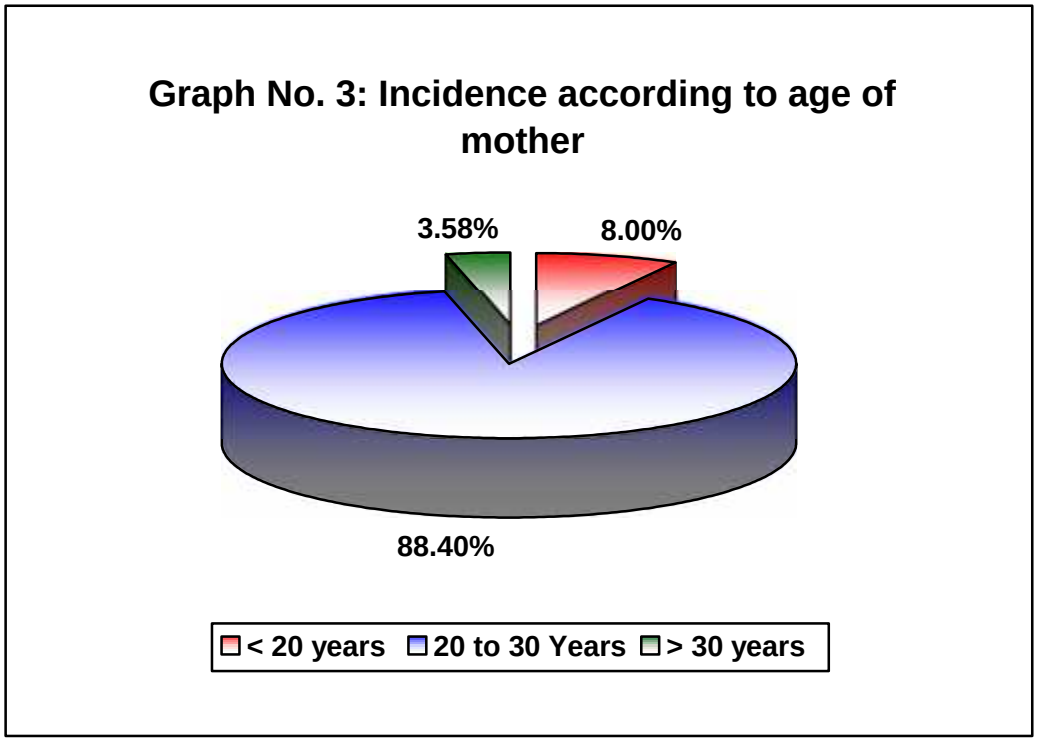
Table 5: Loss of fetal movements to delivery interval

Loss of fetal movements to delivery interval	Total (n = 22)
<24 hrs	16
1 – 3 days	6
≥4 days	0

Out of 22 registered stillbirths, 17 were induced and 5 were spontaneous deliveries. Cesarean section was done in 5 cases, due to abruption. In the present study, 6 registered cases presented to the hospital with fetal heart sounds. Out of those 6 cases, congenital anomalies(3) , severe preeclampsia with IUGR(2) and intrapartum birth asphyxia (1). Most of the women in registered group(n=16) had lost fetal movements to delivery interval less than 24 hours.

Table 6: Incidence according to age of mother

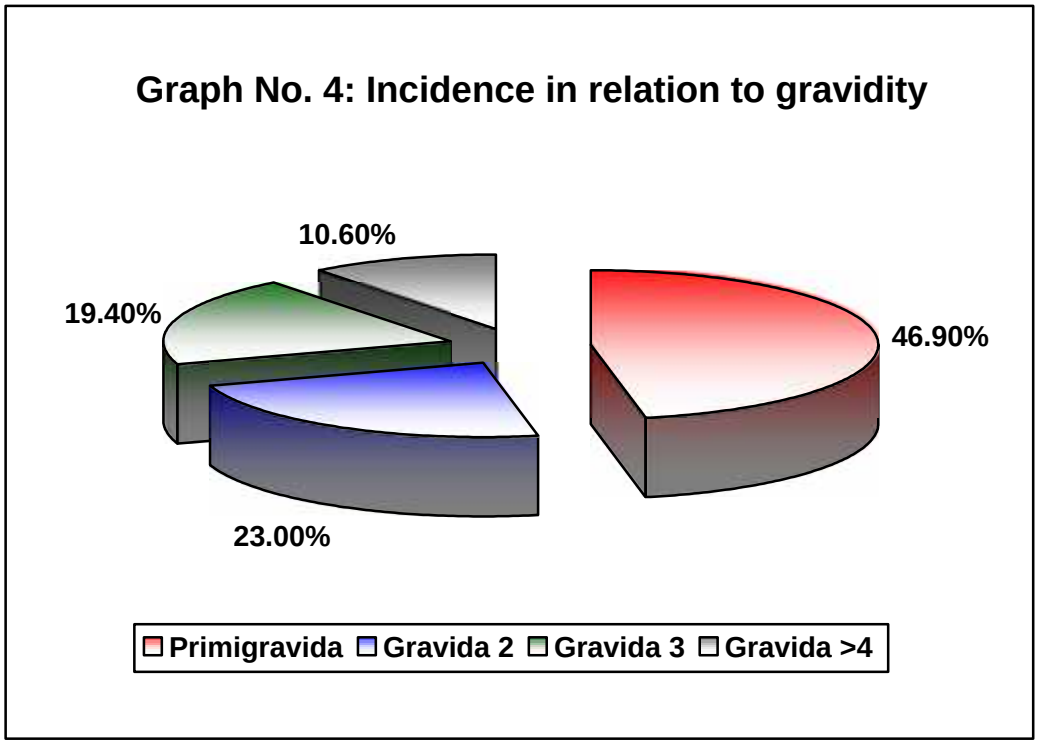
Age	No. of stillbirths (n=110)		Percentage
	Registered	Unregistered	
< 20 years	1	9	8%
20 – 30 years	21	76	88.4%
> 30 years	0	4	3.5%



Stillbirths were maximum in 20 – 30 years of maternal age (88.4%) compared to advanced maternal age. (Table 6)

Table 7: Incidence in relation to gravidity

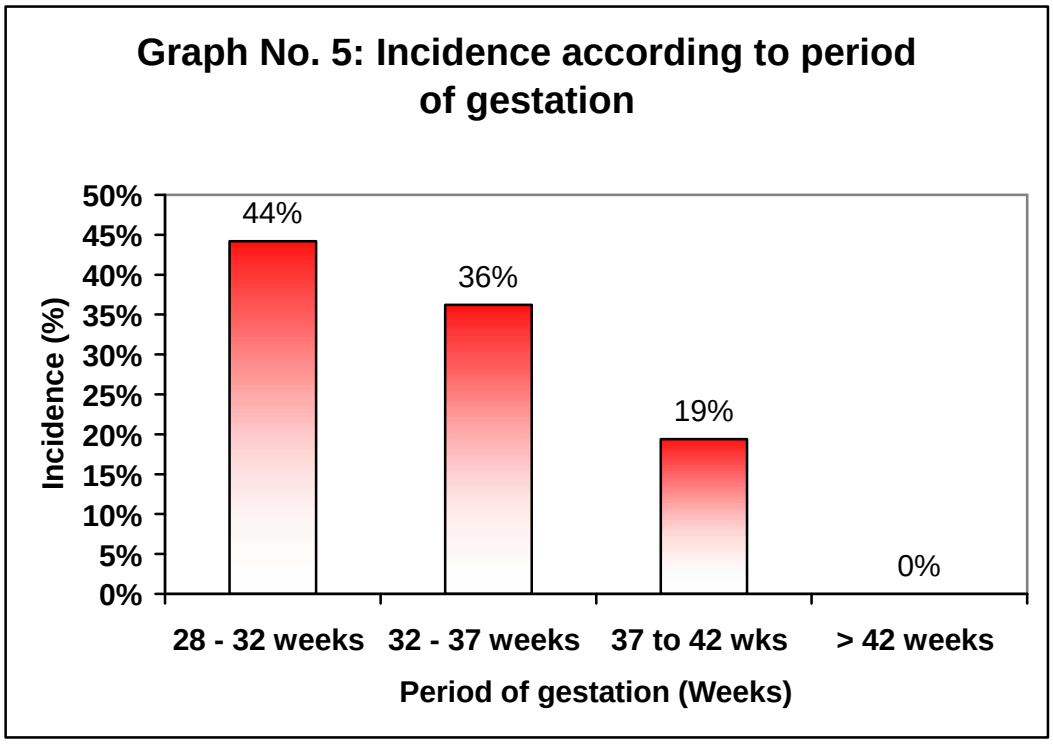
Gravidity	Total (n = 110)		Percentage
	Registered	Unregistered	
Primigravida	11	42	46.9%
Gravida 2	7	18	23%
Gravida 3	2	19	19.4%
Gravida ≥4	2	9	10.6%



Stillbirths were more in primigravidas (47%) compared to subsequent pregnancies(G2 – 23%, G3 – 19%, G≥4 – 11%). (Table 7)

Table 8: Incidence according to period of gestation

Gestational age	Total (n = 110)		Percentage
	Registered	Unregistered	
28 – 32 weeks	7	42	44.2%
32 w1 d – 37 w	9	30	36.2%
37 w 1 d – 42 weeks	6	16	19.4%
> 42 weeks	0	0	0



Almost 80% of stillbirths were preterm and nearly 45% were less than 32 weeks period of gestation. Stillbirths at term were 19.4% (n = 22).. (Table 8)

Table 9: Incidence according to mode of delivery

Mode of delivery	Total (n = 110)		Percentage
	Registered	Unregistered	
Induced	17	43	55.7%
Spontaneous	5	45	44.2%
Vaginal delivery	17	59	68.1%
Cesarean section	5	29	31.8%

Table 10: Mode of delivery and gestational age

Gestational age	Total (n = 110)	
	Induced	Spontaneous
28 – 32 weeks	30	19
32 w1 d – 37 w	25	14
37 w 1 d – 42 weeks	7	15
> 42 weeks	0	0

In the present study, 50 (44.2%) stillbirths deaths were spontaneous deliveries and 63 (55.7%) were induced. Out of 63 induced, 55 cases were preterm (<37 weeks). Almost 77 (68.1%) stillbirths deaths delivered vaginally and 36 (31.8%) cases delivered by cesarean section.

Incidence according to presence of cardiac activity

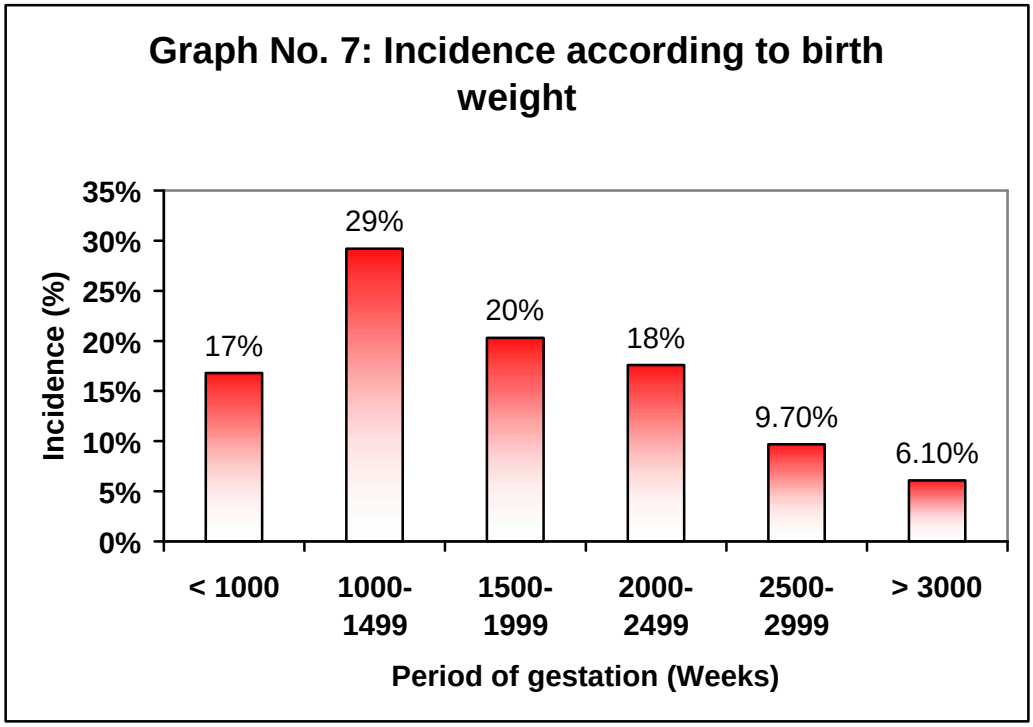
In the present study, 94 cases of perinatal deaths presented to the hospital without fetal heart sound and 19 cases presented with fetal heart sound. Among those 19 cases, 3 were early neonatal death and 16 stillbirths. Out of 16 (14.5%) stillbirths, cause of death was due to severe preeclampsia (7), congenital anomalies (6),intrapartum birth asphyxia (6), severe intrauterine growth restriction (5), preterm (10) and maternal infection like malaria(1) and septicemia (1). Out of 16 stillbirths, 6 cases were registered and 10 were unregistered.

Table 11: Cause of death

Cause of death	Total (Numbers)
Severe preeclampsia	7
Preterm	10
Congenital anomalies	6
Birth asphyxia	6
Severe IUGR	5
Maternal infection	2

Table 12: Incidence of according to birth weight

Birth weight (g)	Total Number (n = 110)		Percentage
	Registered	Unregistered	
≤ 1000	1	17	16.8%
1000 – 1499	7	25	29.2%
1500 – 1999	4	19	20.3%
2000 – 2499	5	14	17.6%
2500 – 2999	4	7	9.7%
≥ 3000	1	6	6.1%



Stillbirths were more common in low birth weight babies. There were 95 babies weighing less than 2500 grams (84%). Among them, babies weighing less

than 2000 grams were 75 (66.3%) and weighing less than 1500 gram were 52 (46%). Only 15% of stillbirths occurred in babies weighing more than 2500 gram. It was observed that as the birth weight increased stillbirths decreased, among the babies weighing more than 1000 grams. Among the registered group, maximum number (17) of stillbirths were seen in low birth weight group (<2500g).

In low birth weight group, important cause of death were abruption (31),severe preeclampsia (25), IUGR (20), unknown (15), congenital anomalies (6), placenta previa (5) and others like preterm labor, diabetes mellitus, birth asphyxia.

Table 13: Macerated stillbirths

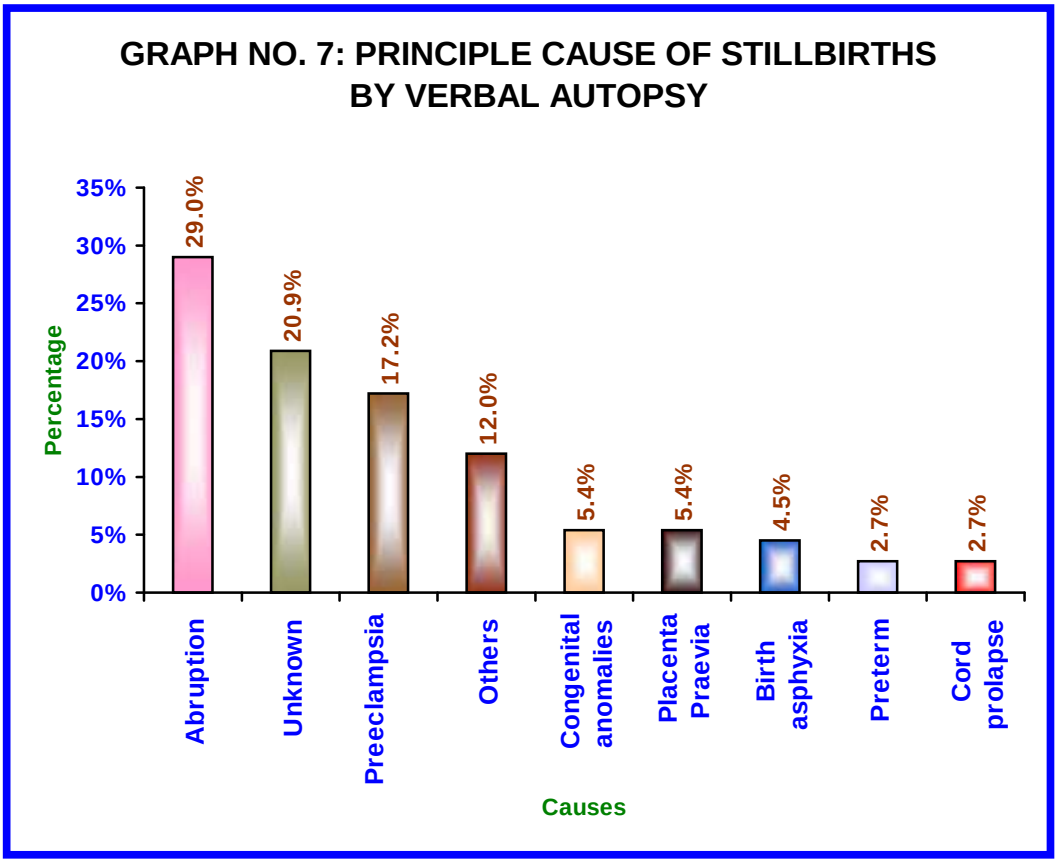
Macerated stillbirths		Total number
Birth weight (grams)	<1500	18
	1500 – 2500	14
	>2500	2
Gestational age (weeks)	<32	10
	32 – 37	13
	>37	11
Registered		6
Unregistered		28
Last ANC visit	>4 wks	6
Loss of fetal movement to delivery interval	<24 hrs	6
	1 – 3 days	18
	≥4 days	10

Maximum number (n= 32) of the macerated stillbirths (MSB) were less than 2500 grams and in less than 37 wks gestation. Only 6 cases of macerated stillbirths were registered. Women had their ANC visits more than 4 weeks back. In the registered cases, causes were mainly severe preeclampsia, abruption, IUGR and undetermined in 2 cases. Majority of the women with MSB had loss of fetal movements to delivery interval more than 24 hours. In MSB, causes were severe preeclampsia (14), undetermined (14), severe IUGR (10), abruption (6) and diabetes mellitus (2).

Verbal autopsy: Cause of death

Table 14: Principle cause of stillbirths by verbal autopsy

Causes	Total (n = 110)	Percentage
Abruption	32	29%
Unknown	23	20.9%
Severe pre eclampsia	19	17.2%
Congenital Anomalies	6	5.4%
Placenta Previa	6	5.4%
Birth Asphyxia	5	4.5%
Maternal Infections	5	4.5%
Preterm labour	3	2.7%
Cord prolapse	3	2.7%
Severe IUGR	2	1.8%
Eclampsia	2	1.8%
Gestational Diabetes	2	1.8%
Uterine rupture	1	0.9%
Immune hydrops	1	0.9%



In present study, principle cause of stillbirths on verbal autopsy(VA) was abruptio placentae and severe pre-eclampsia. The cause of death was determined in almost 80% of the cases. (Table 14)

Table 15: Number of associated factors in stillbirth

Associated factors (number)	Total Number (n=53)
>1	30
>2	13
≥3	10

Among 110 stillbirths, 53(48.0%) cases had multiple factors contributing to fetal death and 37 cases had single cause for fetal death.

Table 16: Multiple etiologies in stillbirths

Causes	Registered	Unregistered	Total
Abruption	11	21	32
Unknown	2	21	23
Severe pre eclampsia	10	28	38
Congenital Anomalies	2	9	11
Placenta Previa	1	5	6
Birth Asphyxia	1	8	9
Maternal Infections	0	5	5
Preterm	16	72	88
Cord prolapse	1	2	3
Severe IUGR	4	19	23
Eclampsia	1	3	4
Gestational Diabetes	0	2	2
Uterine rupture	0	1	1
Immune hydrops	0	1	1

Table 17: Stillbirths with unknown cause

Stillbirths with unknown cause		**Total number**
Macerated stillbirths		14
Fresh stillbirths		9
Birth weight (grams)	<1500	9
	1500 – 2500	7
	>2500	7
Gestational age (weeks)	>37	15
	32 – 37	4
	<32	4
Unregistered		20
Registered		03
Last ANC visit	>4 wks	3
Loss of fetal movement to delivery interval	<24 hrs	6
	1 – 3 days	14
	≥4 days	3
Associated IUGR		6

Congenital anomalies

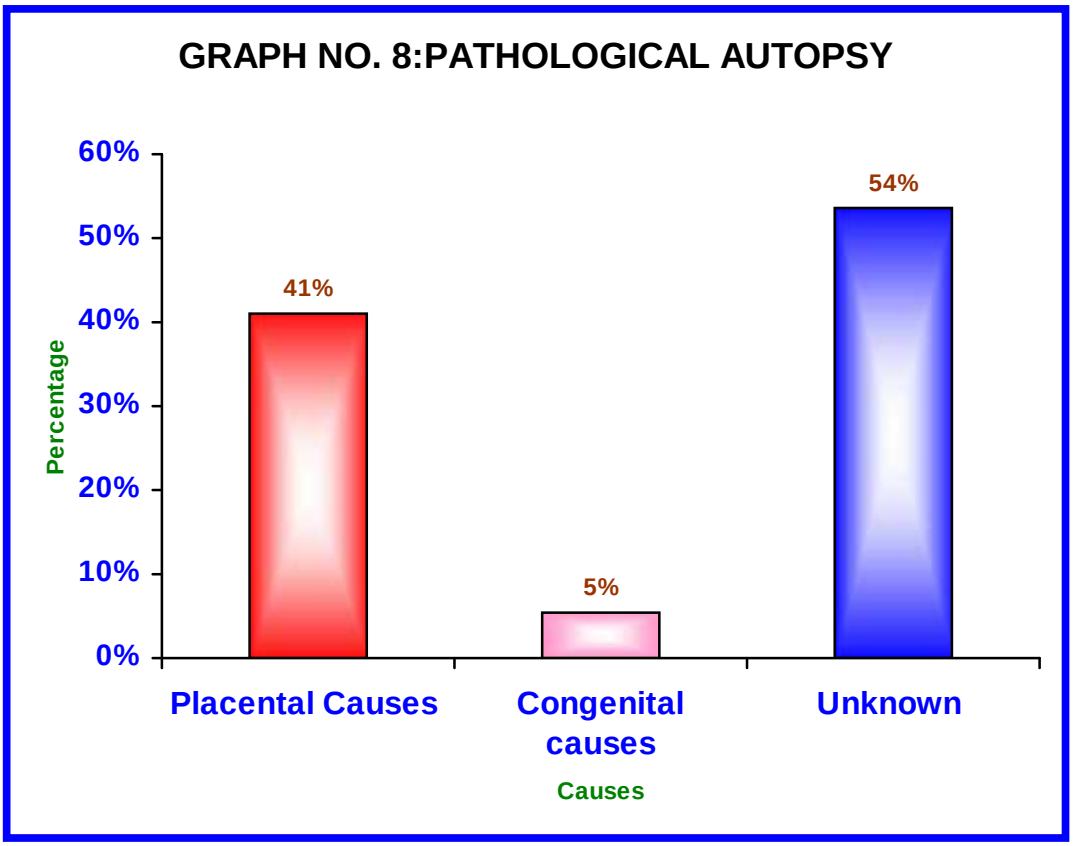
On verbal autopsy, eleven perinatal deaths with congenital anomalies were detected but only six cases were directly responsible for fetal death. They were hydrocephalus (3), anencepaly (1), hypoplasia of lung with renal agenesis and limb defect (1) and bilateral multicystic kidneys (1). Other subtle defects

were cleft lip and palate (1), congenital talipo equinovarus (CTEV) (1), limb defect (1), imperforate anus (1) and low set ears with flattened nasal bridge (1).

Pathological autopsy: Cause of death

Table 18: Principle causes of stillbirths by pathological autopsy

Cause	Total No.	Percentage
Unexplained	59	53.6%
Placental pathology	45	40.9%
Congenital Malformation	6	5.4%



On pathological autopsy (PA), cause was determined in 46% of cases. Clinical information was given for pathological autopsy, to arrive at the cause of death. Placental pathology attributed to 40.9% of stillbirths. Congenital malformation were 5.4%. (Table 18) Among the unknown cases (23) in verbal autopsy, 3 cases had placental pathology suggestive of preeclampsia on pathological autopsy. Out of which 2 were macerated stillbirths.

Congenital Malformation

Table 19: Congenital Malformation on Pathological Autopsy

Congenital Malformations	Number
Urogenital	9
Skeletal	6
CNS	5
RS	4
CVS	3
GIT	1

On pathological autopsy, though 17 cases had congenital anomalies but only in 6 cases, the anomalies were multiple and responsible for perinatal death. Six additional congenital anomalies were detected on pathological autopsy.

Table 20: Early neonatal death

Sl. No.	R / UR	Gravidity	Gestational age	Birth weight (grams)	Vaginal/ cesarean	No. of days in NICU	Verbal autopsy	Pathological autopsy
1	R	2	34	900	Cesarean	5	Neonatal sepsis, persistent hypotension secondary to prematurity.	Undetermined
2	R	3	34	1400	Vaginal	4	Pulmonary hemorrhage secondary to prematurity	Pulmonary hemorrhage
3	UR	4	32	2000	Cesarean	1	Partial mole with congenital anomalies	Placental pathology (partial mole) with pulmonary hypoplasia, spina bifida, hydronephrosis, hydrocephalus

Out of 25 early neonatal deaths, only 3 consented for the study. Due to small sample size, analysis could not be done. Principle cause of death on verbal autopsy were complication of prematurity (low birth weight, discordant twin and sepsis), pulmonary hemorrhage due to prematurity and partial mole with lethal congenital anomalies. Multiple factors which contributed are preterm (3), IUGR (2), multiple gestation with discordant twin (1), severe preeclampsia (1) and congenital anomaly (1). On pathological autopsy, same findings were confirmed in early neonatal deaths.

Correlation between pathological and verbal autopsy

Table 21: Correlation of VA and PA

Pathological Autopsy				
	Cause	**Determined**	**Undetermined**	**Total**
Verbal Autopsy	**Determined**	51	39	90
	Undetermined	3	20	23
	Total	54	59	113

On verbal autopsy, cause was determined in 90 perinatal deaths. Out of which, cause was determined in 51 cases on pathological autopsy. Cause was determined by pathological autopsy in three of 23 undetermined cases on verbal autopsy. The sensitivity and specificity of verbal autopsy was 94.4 and 34 respectively. The negative predictive value (NPV) and positive predictive value (PPV) of verbal autopsy was 87 and 56.6 respectively.

Abruption:

Table 22: Correlation of VA and PA in Abruption

Pathological Autopsy				
	Abruption	**Present**	**Absent**	**Total**
Verbal Autopsy	**Present**	14	18	32
	Absent	3	78	81
	Total	17	96	113

On verbal autopsy, there were 32 cases of abruption. On pathological autopsy only 19 cases had placental changes suggestive of abruption. Three case of abruption was detected on pathological autopsy which was not detected on verbal autopsy. There was 51.3% Correlation between verbal autopsy (VA) and pathological autopsy (PA). The sensitivity and specificity of verbal autopsy was 86.3 and 80.2 respectively. The negative predictive value (NPV) and positive predictive value (PPV) of verbal autopsy was 96.05 and 51.3 respectively.

Severe Pre-eclampsia:

Table 23: Correlation of VA and PA in severe pre-eclampsia

	Pathological Autopsy			
	PIH	**Present**	**Absent**	**Total**
Verbal Autopsy	**Present**	30	8	38
	Absent	8	67	75
	Total	38	75	113

In the present study, there were 38 cases of severe pre-eclampsia on verbal autopsy. On pathological autopsy, 30 cases had placental changes suggestive of severe pre-eclampsia. 8 additional cases were detected on pathological autopsy. There was 78.9% correlation between verbal and pathological autopsy in severe pre-eclampsia (PIH). The sensitivity and specificity of verbal autopsy is 80.3 and 89.3 respectively. The negative predictive value (NPV) and positive predictive value (PPV) of verbal autopsy is 89.3 and 78.9 respectively.

DISCUSSION

Perinatal death is a traumatic experience for both mother and the obstetrician. Despite the advances in fetomaternal medicine, perinatal death rate continues to be high. The present study was an observational study to evaluate the cause of perinatal death by verbal and pathological autopsy and its correlation.

Incidence of perinatal mortality

In the study period, there were 3904 deliveries and 193 perinatal deaths. Studies have reported a perinatal mortality rate between 45 to 51 per 1000 births.[2,5] In the present study, perinatal mortality rate was 49.4 per 1000 births. Out of 193 perinatal deaths, stillbirths were 168 and early neonatal deaths were 25. Stillbirth rate was 43 per 1000 births. Stillbirth rate was higher compared to other studies.[2,5,6,27] In the present study, though all perinatal deaths(193) were screened, only 113(58.5%) consented. The reason for not participating in the study was mainly lack of willingness for pathological autopsy in 41.5% due to ritual/ religious reasons, specially so in case of early neonatal deaths.Out of 113 perinatal deaths, there were 110 stillbirths and three early neonatal deaths. Out of 110 stillbirths, 76(67.2%) were fresh stillbirths and 34(30.2%) were macerated stillbirths. Due to small sample size, analysis could not be done in early neonatal deaths.

Stillbirths were more in unregistered cases (79%) than in registered (21.4%). Similar findings noted in various other studies.[2,4,5,17,27,46] Among the

registered cases, 50% of the stillbirths were due to abruption. Majority of them were fresh stillbirths. Most of the registered women had their loss of fetal movement to delivery interval less than 24 hours. Majority of the women (68%) had their last antenatal visit more than four weeks back. There is urgent need for the more frequent visits in the last trimester of the pregnancy. Stillbirths in registered cases were mostly due to irregular antenatal care specially in the later part of pregnancy. Unregistered cases contribute to suboptimal care by non utilization of antenatal care services. Reduction in the stillbirths could be facilitated by increasing awareness for early registration of pregnant women for antenatal care and more frequent visits in the last trimester.

Maximum numbers of stillbirths were obsevered in 20 – 30 year old women (88.4%). Age of the mother was an important contributing factor for perinatal deaths. Similar findings were reported in other studies.[1, 4,5,47] But in few other studies, advanced maternal age were at higher risk of perinatal deaths.[20,27,46,47]

Stillbirths were observed more in multigravidas (53%) compared to primigravidas (47%). Similar findings were observed in other studies.[5,23,27,38,45] Maximum number of stillbirths(79%) in primigravidas were unregistered cases. Principle cause of stillbirths among them were severe preeclampsia and abruption. A good antenatal care, early detection of high risk cases and timely referral to tertiary centres could reduce the incidence of stillbirths.

Stillbirths vary inversely with gestational age. Almost 80% of stillbirths were preterm and nearly 45% were less than 32 weeks period of gestation.

Stillbirths at term were 19.4%.Similar findings were observed in other studies.[1,2,4,5,20,27] The term stillbirths may be avoided by use of special tests like colour doppler, ultrasonography and weekly non stress test(NST) in those where acute complications like abruptio placentae were absent.

In the present study, most of the stillbirths delivered vaginally (68.1%) and around 44% had spontaneous onset of labour. Similar findings were observed in other studies.[5]

Around 14% of stillbirths, presented to the hospital with cardiac activity. Cause of death in them were due to severe preeclampsia, congenital anomalies, intrapartum birth asphyxia, severe intrauterine growth restriction, preterm and maternal infection like malaria and septicemia. Preterm labor, birth asphyxia and IUGR are important associations with stillbirths. Special emphasis and specialized care with economic support may be of help in reducing these deaths.

Stillbirths were more common in low birth weight babies that are weighing less than 2500 grams (84%). Only 15% of stillbirths occurred in babies weighing more than 2500 gram. It was observed that as the birth weight increased stillbirths decreased, among the babies weighing more than 1000 grams. Similar findings were observed in other studies.[1,2,4,5,20,27] In low birth weight group, important cause of death were abruption, severe preeclampsia, preterm , IUGR, unknown, congenital anomalies and placenta previa.

Macerated stillbirth

In the present study, 30.2% were macerated stillbirths. Majority of the macerated stillbirths were low birth babies (<2500 g) and in less than 37 wks gestation. In MSB, causes were severe preeclampsia, undetermined, severe IUGR, abruption and diabetes mellitus. Majority of the women with MSB had loss of fetal movements to delivery interval more than 24 hours. Majority of macerated stillbirths were unregistered. Similar findings were noted in a study.[49]

Verbal Autopsy

The principal cause of death was determined in almost 80% of the stillbirths by verbal autopsy and about in 20%, it was undetermined. Antepartum hemorrhage and severe pre eclampsia attributed to almost 49% of stillbirths in both registered and unregistered cases. Similar findings were observed in other studies.[2,4,8,14,15,27] Pregnancy induced hypertension (PIH) and eclampsia together accounted for 18% of stillbirths. Similarly noted in other studies.[2,4,8,14,15,27] A good antenatal care, early detection of PIH and timely referral along with specialized tests like thrombophilias and interventions like aspirin, would reduce the stillbirths.

In about 21% of the stillbirths, cause was undetermined .It is comparable to other studies.[2,4,5] Probably additional tests like immunohistochemical, serological and genetic tests would help in determine the cause of perinatal death. Congenital malformation was the principle cause of death in 5.4% of the cases as noted in other studies. [1,2,4,5,27]

The other principle causes of stillbirths were birth asphyxia (4.5%), maternal infections (4.5%), cord prolapse (2.7%), preterm (2.7%) and severe intrauterine growth restriction (1.8%). Similar findings were noted in other studies.[2,5,8,27]

In the present study, almost 48% of the cases had multiple associated factors leading to fetal demise. Around 80% of them had more than 2 factors leading to stillbirths as noted in other study.[48]

Among the undetermined cases, majority were macerated stillbirths and were of low birth weight (<2500 g). Around 65% of them were more than 37 weeks period of gestation. Similar findings noted in other study.[49] Majority of the women with stillbirths of unknown cause, had loss of fetal movements to delivery interval more than 24 hours. Around 26% of them had associated IUGR. Special tests like NST and colour Doppler at this period of gestation definitely identify at risk babies and prevent these deaths.

Pathological Autopsy

The autopsy rate in the present study was 58%. On pathological autopsy, the principle cause of stillbirths were placental pathology (41%) and congenital anomalies (5.4%). But unexplained in almost 53.6% of stillbirths. Clinical information was given for pathological autopsy, to arrive at the cause of death. In other studies, 60% of stillbirths is attributed to placental pathology and only 15% were unexplained, as other immunochemical and genetic tests were conducted.[1,3] Among the unknown cases (23) in verbal autopsy, 3 cases had placental

pathology suggestive of preeclampsia on pathological autopsy. Out of the 3 cases, 2 were macerated stillbirths and one fresh stillbirth.

Congenital malformations attributed to 6.2% of stillbirths, similar to other studies. [1,3,43] It was noted that 6 fetuses had multiple anomalies. Six additional congenital anomalies were detected on pathological autopsy.

Early neonatal death

In the present study, out of 25 early neonatal deaths only 3 consented. Principle cause of death on verbal autopsy were complication of prematurity (low birth weight, discordant twin and sepsis), pulmonary hemorrhage due to prematurity and partial mole with lethal congenital anomalies. Multiple factors which contributed were preterm (3), IUGR (2), multiple gestation with discordant twin (1), severe preeclampsia (1) and congenital anomaly (1). On pathological autopsy, same findings were confirmed in two early neonatal deaths. As the data size was small, analysis could not be done in early neonatal deaths.

Correlation of verbal and pathological autopsy

There are no published studies till date for correlation of verbal and pathological autopsy. In the present study, the verbal autopsy has an increased sensitivity (94.4) than specificity (34) and high negative predictive value (NPV) (87) in determining the cause of death in stillbirths.

In present study, the sensitivity and specificity of verbal autopsy in stillbirths due to abruption was 86.3 and 80.2 respectively. The negative predictive value (NPV) and positive predictive value (PPV) of verbal autopsy

was 96.05 and 51.3 respectively. There was 78.9% correlation between verbal and pathological autopsy in severe pre-eclampsia (PIH). The sensitivity and specificity of verbal autopsy was 80.3 and 89.3 respectively. The negative predictive value and positive predictive value of verbal autopsy was 89.3 and 78.9 respectively.

A simple pathological autopsy without histochemistry, serological tests and chromosomal/ genetic evaluation is less superior. Hence pathological autopsy with these tests can detect the cause upto 94% cases.[13] this is one of the limitations of this study.

Limitations of the study

1. In the present study, though all perinatal deaths (193) were screened, only 58.5% consented (113). The reason for not participating in the study was mainly lack of willingness for pathological autopsy in 41.5% due to ritual/ religious reasons, specially so in case of early neonatal deaths. Analysis could not be done in early neonatal deaths as it was too smaller sample.

2. The pathological autopsy included only gross and microscopic examination without any histochemical and serological tests. Probably combination helps to determine cause of death in many cases of perinatal deaths.

Table 21: Causes of stillbirths in different studies

	Antepartum haemorrhage (%)	Unexplained (%)	Severe preeclampsia (%)	Congenital anomalies (%)	Preterm (%)
Present Study	33.6%	20.3%	18.5%	6.1%	2.6%
Sujata et al [2]	19.0%	22.3%	15%	3.3%	13.2%
Nayak VNK et al [5]	24%	18.8%	18.8%	9.4%	8.4%
Gaddi SS et al[32]	20.0%	13.0%	25.0%	7.0%	13.0%

CONCLUSION

From the present study, it is evident that the Verbal autopsy is a important tool in evaluation of cause in stillbirths (80%). Pathological autopsy when combined with clinical data could determine cause in only 46% of stillbirths. Pathological autopsy without histochemical, serological tests and chromosomal/ genetic evaluation, determined additional congenital anomalies.

Verbal autopsy is simple, cost effective and reliable tool in evaluating cause of death in resource poor settings. It helps in prevention of still births and early neonatal death where detailed pathological autopsy is not feasible (lack of availability/ willingness), for the improved perinatal outcome.

Analysis of stillbirths helps the obstetrician to assign the cardinal cause responsible for train of events leading to death and take adequate measures in antenatal care to prevent these deaths.

SUMMARY

- The descriptive observational study was conducted at teaching hospital attached to Jawaharlal Nehru Medical College, Belgaum for a period of 18 months (December 2007 to May 2009).

- In the study period, there were 3904 deliveries and 193 perinatal deaths. The perinatal mortality rate was 49.4 per 1000 births and stillbirth rate was 43 per 1000 births.

- Though all perinatal deaths (193) were screened, only 113 (58.5%) consented. Out of 113 perinatal deaths, there were 110 stillbirths and three early neonatal deaths. Out of 110 stillbirths, 76 (67.2%) were fresh stillbirths and 34 (30.2%) were macerated stillbirths. Due to small sample size, analysis could not be done in early neonatal deaths.

- On verbal autopsy, the principle cause of death was determined in 80% of stillbirths and 20% was undetermined. Antepartum hemorrhage and severe pre eclampsia contributed to around 42% of stillbirths. Congenital anomalies (6.1%), birth asphyxia (4.4%), maternal infections (4.4%), and preterm (2.6%) were other causes.

- On pathological autopsy, majority of stillbirths remained unexplained (52%). Placental pathology (42%) and congenital malformation (6.2%) were the principle cause of death determined by pathological autopsy. Six additional congenital anomalies were detected on pathological autopsy.

- The verbal autopsy has an increased sensitivity (94.4) and high negative predictive value (87) in determining the cause of death in stillbirths.

- Present study shows that verbal autopsy is simple, cost effective and reliable tool in evaluating cause of perinatal deaths and for the improved perinatal outcome.

BIBLIOGRAPHY

1. D'costa GF, Patil Y. Causes of Mortality in Still Birth – An autopsy study. Bombay Hospital J 2007; 49(2):

2. Sujata, Das V, Agarwal A. A study of perinatal deaths at a tertiary care teaching hospital. J Obstet Gynecol India 2008; 58(3): 235-8.

3. Horn LC, Langer A, Stiehl P, Wittekind C, Faber R. Identification of the causes of intrauterine death during 310 consecutive autopsies. Eur J Obstet Gynecol Reproduct Biol 2004; 113(2): 134 -8.

4. Kulkarni R, Chauhan S, Shah B, Menon G, Puri C. Investigating causes of perinatal mortality by Verbal Autopsy in Maharashtra, India. Indian J Comm Med 2007; 32(4): 259-63.

5. Nayak K, Vaishali N, Gaikwad PR. Causes of stillbirth. J Obstet Gynecol India 2008; 58(4): 314-7.

6. McClure EM, Wright LL, Goldenberg RL, Goudar SS, Parida SN, Jehan I, et al. The global network: a prospective study of stillbirths in developing countries. Am J Obstet Gynecol 2007; 197: 247 e1-5.

7. Gabriela C. Systematic review on the incidence/prevalence of stillbirths. Geneva: Geneva Foundation for Medical Education and Research (WHO); 2001.

8. Ngoe NTN, Merialdi M, Abdel-Aleem H, Ali MM. Causes of still births and early neonatal deaths: data from 7993 pregnancies in six developing countries. Bull World Health Org 2006; 84: 699-705.

9. Neville RB, Dennis GB. Perinatal Mortality: the first report of 1958 British perinatal mortality survey. London: The National Birthday Trust Fund. E. & S. Livingstone Ltd.; 1963.

10. Study Protocol: Using verbal autopsy to determine cause of still births and early neonatal deaths within the NICHD global network. Washington DC: Global Network for Women's and Children's Health; 2007.

11. Soleman N, Chandramohan D, Shibuya K. Verbal autopsy: Current practices and challenges. Bull World Health Organ 2006; 84(3): 239-45.

12. Silver RM. Fetal death. Obstet Gynaecol 2007; 109 (1): 153-67.

13. Ona M, Peterson F, Guinn DA, Katharine D. Wenstrom. Value of perinatal autopsy. Obstet Gynaecol 1999; 94(6): 915-20.

14. Lawn JE, Cousens S, Zupan J. 4 million neonatal deaths: When? Where? Why? Lancet 2005; 365 (9462): 891-900.

15. Cruikshank DP, Linygeal AS. Term stillbirth: causes and potential for presentation in virginia. Obstet Gynaecol 1987; 69(5): 841- 4.

16. Cunningham FG, Kenneth JL, Steven LB, John CH, Larry CG, Katharine D. William's Obstetrics: Obstetrical Hemorrhage. 22nd edition, New York ; McGraw Hill Companies Inc.; 2005.

17. Pradeep M, Rajam L, Sudevan P. Perinatal Mortality – A Hospital based study. Indian Pediatr 1995; 32: 1091–4.

18. Dudley DJ. Diabetic - Associated stillbirth: Incidence, pathophysiology and prevention. Obstet Gynecol Clin N Am 2007 ; 34 : 293-307.

19. Mangala R, Mhaskar R, Mhaskar A, Lillian T, Narayanan R. Perinatal outcome in pregnancy complicated by diabetes mellitus. Intnl J Diab Dev Countries 1991; 11: 22-4.

20. Silver RM, Varner MW, Reddy U, Goldenberg R, Pinar H, Conway D. et al. Work- up of stillbirth: A review of the evidence. Am J Obstet Gynecol 2007; 433- 44.

21. Lawn J, Shibuya K, Stein C. No cry at birth: global estimates of intrapartum stillbirths and intrapartum related neonatal deaths. Bull World Health Organ 2005: 83(6): 409-17.

22. Michael SK, Shiliang L, Zhongcheng L, Hongbo Y, Robert WP, Joseph KS. Analysis of perinatal mortality and its components: Time for a change? Am J Epidemiol 2002; 156: 493-7.

23. Fretts RC. Etiology and Prevention of stillbirth. Am J Obstet Gynecol 2005; 193: 1923-35.

24. Korteweg FJ, Gordijn SJ, Timmer A, Holm JP, Ravise JM, Erwich JJ. A placental cause of intra-uterine fetal death depends on the perinatal mortality classification system used. Placenta 2008 ; 29 : 71-80.

25. Saha S, Arijot Saha. Clinical Audit of perinatal mortality – A reappraisal of major determinants and its prevention. J Obstet Gynecol India 2002; 52(3): 83-6.

26. Shinde A. Perinatal mortality – identification of risk factors. J Obstet Gynecol India 2003; 53(3): 40-3.

27. Lucy D, Umakant S, Niharika P. Perinatal mortality in a referral hospital of Orrisa – A 10 year review. J Obstet Gynecol India 2005; 55(6): 517-20.

28. Chandramohan D, Soleman N, Shibuya K, Porter J. Ethical issues in the application of verbal autopsies in mortality surveillance systems. Trop Med Int Health 2005; 10: 1087-9.

29. Setel PW, Osman S, Chalapati R, Victoria A, Colin M, Yang G, et al. Sample registration of vital events with verbal autopsy : A renewed commitment to measuring and monitoring vital statistics. Bull World Health Organ 2005; 83(8): 611-5.

30. Ingrid GB, Fredrik HS, Gisela GD, Bengt AJ. NICE, a new cause of death classification for stillbirths and neonatal deaths. Int J Epidemiol 1998; 27: 499-504.

31. Baqui AH, Darmstadt GL, Williams EK, Kumar V, Kiran TU, Panwar D, et al. Rates, timing and causes of neonatal deaths in rural India: implications for neonatal health programmes. Bull World Health Organ 2006; 84: 706-13.

32. Gaddi SS, Seetharam S. A study of perinatal mortality in head quarters hospital Bellary. J Obstet and Gynec India 2001; 51(6): 101-3.

33. Benara SK, Singh P. Validity of causes of infant death by verbal autopsy. Indian J Pediatr 1999; 66(5): 647-50.

34. Iriya N, Manji KP, Mbise RL. Verbal autopsy in establishing cause of perinatal death. East African Med J 2002; 79: 82-4.

35. Ludwig J. Handbook of Autopsy Practice. 3 rd edition. Totowa: Humana Press Inc.; 2002.

36. Tennstedt C, Hufnagl P, Chaoui R, Korner H, Dietel M. Fetal autopsy: a review of recent developments. Eur Obstet Gynecol Reproduct Biol 2001; 99(1): 66 -71.

37. Stanton C, Lawwn JE, Rahman H, Ketende KW, Hill K. Stillbirth rates: Delivering estimates in 190 countries. Lancet 2006; 368 (9530): 117-8.

38. Alexandra GE, Ware D, Janice LB. Stillbirth at term. Obstet Gynecol 2006; 108(2): 442-7.

39. ACOG Committee Opinion No. 383: Evaluation of stillbirths and neonatal deaths. Obstet Gynecol 2007; 110(4): 963-6.

40. Paula C, Ann SN, Carolyn L, Grace G. Guidelines for investigating stillbirths: An update of a systematic review. J Obstet Gynecol Can 2007; 29(7): 560-7.

41. Leduc L. Stillbirth and Bereavement: AAA guidelines for stillbirth investigations. J Obstet Gynecol Can 2006; 178(7): 540-5.

42. Management of Stillbirth. ACOG Practice Bulletin. #102: 2009.

43. Chitralekha PD, Vijaya VM, Saraswati GR, Anupama V. Perinatal autopsy – A six year study. Indian Pediatr 1998; 35: 545-8.

44. Guidelines for autopsy investigation of fetal and perinatal death. RC Path; 2002.

45. Smith GCS. Sex, birth weight and the risk of stillbirth in Scottland, 1980 – 1996. Am J Epidemiol 2000; 151: 614-9.

46. Darios G, Cande VA, Wendy LK. Risk factors for antepartum and intrapartum stillbirth: a population-based study. Am J Obstet Gynecol 2007: 196(6): 499-507.

47. Uma MR, Chia-Wen Ko, Marian W. Maternal age and the risk of stillbirth throughout pregnancy in the United States. Am J Obstet Gynecol 2006; 195: 764 -70.

48. Murphy M, Botting B. Contrasts in the multiple causes of stillbirths, neonatal death and postneonatal death. J Epidemiol Community Health 1989; 43: 343-5.

49. Shingairai AF, Sioban DH, Kathy W, Brenda WG. Incidence of stillbirth and perinatal mortality and their associated factors among women delivering at Harare Maternity Hospital, Zimbabwe: A cross sectional retrospective analysis. BMC Pregnancy Childbirth 2005; 5: 9.

ANNEXURE I

CONSENT FORM

ID NO: BVA ☐☐☐

Title: Evaluation of still birth and early neonatal death by verbal and pathological autopsy and their correlation – One year hospital based descriptive observational study.

Perinatal death complicates 1.5% of all births. The purpose of this study is to learn more about the cause of still birth and early neonatal death. About 100 women with still birth / early neonatal death, delivered in J. N. Medical College teaching Hospital will be enrolled into the study.

This study is under the guidance of Dr. M. B. Bellad, Professor, Department of OBG, J. N. Medical College, Belgaum. Your participation in the study is voluntary. You should be willing to answer the questions about your pregnancy, baby's birth and death and you are supposed to answer to the best of your knowledge. I am sorry that your baby died. You should be willing to send the baby and placenta for autopsy.

By agreeing to participate in this study, you will be a valuable contributor towards understanding more about the cause of still birth and early neonatal death. This study will form a basis for many such studies and will aid in the prevention of still birth and early neonatal death. Your participation in this study, is not likely to have any adverse effects. Standard care will be provided even if

you refuse to participate in this study. You will be given an ID No. and the same will be used for study purpose and that prevents your identification, confidentiality of the data will be maintained. There are no financial incentives to you for participating in this study. Results may be published for medical or scientific purpose and you will not be identified.

Your participation in the study is voluntary. Whether you participate or not, it would not affect your treatment. You can discontinue at any time for any reason. In case of emergency you may contact Dr. Srividhya, Mobile No: 94803 91409 or Dr. M. B. Bellad, Mobile No. 94481 24893.

If you have any questions about the study you can contact Dr. M. B. Bellad, Professor, Department of Obstetrics and Gynaecology, J. N. Medical College, Belgaum. In case you need any further information regarding your rights as a study participant, you may please contact Dr. V. D. Patil, Principle and Chairman of J. N. Medical College, Institutional Ethics Committee, Mobile No. 94481 90231.

Consent statement

I volunteer and consent to participate in this study. I have read the consent document or it has been read to me in my vernacular language. I accept to participate in this study. All the information regarding this study is provided to me and I have understood the same. I have been given the opportunity to ask questions and obtain appropriate answers.

Participants Name _____

Signature/thumb impression _____

Investigator's name _____

Investigator's signature _____

Witness name _____

Witness Signature _____

Date _____

ANNEXURE II – PROFOMA

Evaluation of still birth and early neonatal death by verbal and pathological autopsy – One year descriptive study in J. N. Medical College Teaching Hospital, Belgaum

ID No: BVA ☐☐☐

To be completed by health care provider for every women screened for enrollment in the study.

I. SUBJECT INFORMATION

1. Name of the woman: F _____ M _____ S_____
2. Address: H. No. _____Street _____ Place _____
   Taluka _____ District _____ Ph No _____
3. Age: ☐☐
4. Occupation: HW / Working
5. Education ☐
   a. Illiterate b. Read / Write c. Primary d. Secondary
   e. Graduate f. Post graduate
6. Monthly income (In Rs.): ☐
   a. < 500 b. 501 – 1000 c. 1001 – 2000 d. 2001 – 3000 e. > 3000
7. I.P. Number: ☐☐☐☐☐☐

II. SCREENING

1. Is baby still birth or early neonatal death ? ☐
   a. Yes b No
2. Is mother alive ? ☐
   a. Yes b No
3. Was consent obtained ? ☐
   a. Yes b No

III. FINAL RESULT INFORMATION

1. Date of Interview ☐☐☐☐☐☐
2. Final Result: ☐
   a. Ineligible b. Eligible Refusal c. Eligible Participating

VERBAL AUTOPSY QUESTIONNAIRE

ID NO.: BVA ☐☐☐

A. Overview: "I would like to ask you some questions concerning symptoms that the baby had/showed when she/he was ill. Some of these questions may not appear to be directly related to his/her death. Please bear with me and answer all the questions. They will help us to get a clear picture of all possible symptoms that the baby had.

a. Date of interview __/ ___/ _____

b. Interviewer name: _____

c. Respondent (Circle one): ☐
   1– Birth attendant
   2 – Mother

d. Date of death: __/ ___/ _____

e. History of events leading to death (Write exactly as the respondent tells you)

B. Symptoms concerning the mother

1. How is the child's mother now ? — 1 – Fine, 2 – Sick ☐
2. Was it a difficult birth (more difficult than usual)? — 1 – Yes, 2 – No, 9 – Don't Know ☐
3. Did the mother have fits before giving birth ? — 1 – Yes, 2 – No, 9 – Don't Know ☐
4. Did/does the mother have high blood pressure ? — 1 – Yes, 2 – No, 9 – Don't Know ☐
5. Did the mother have a febrile illness at time of delivery ? — 1 – Yes, 2 – No, 9 – Don't Know ☐
6. Did the mother suffer from any of the following conditions ? — 1 – Diabetes, 2 – Heart disea, 3 – TB, 4 – Epilepsy, 5 – None, 6 – Abd. trauma ☐
7. Did the mother receive any antenatal care during her pregnancy ? — 1 – Yes, 2 – No, 9 – Don't Know ☐
8. Had the mother received tetanus toxoid vaccination (TT) ? — 1 – Yes, 2 – No (Q10), 9 – Don't Know ☐
9. If Q.8 = Yes, how many TT injections did she receive ? — ____ (Number)

EVENTS DURING THE BIRTH OF THE CHILD

10. Was the child a — 1 – Singleton, 2 – Twin, 9 – Don't Know ☐
11. Was it a forceps or vacuum /delivery ? — 1 – Yes, 2 – No, 9 – Don't Know ☐

12. Was it a cesarean delivery? 1 – Yes 2 – No 9 – Don't Know ☐

13. Was it a prolonged labor? (Prolonged labor is more than 24 hrs) 1 – Yes 2 – No 9 – Don't Know ☐

14. Did waters break 1 day or more before delivery of the baby ? 1 – Yes 2 – No 9 – Don't Know ☐

15. Was there a vaginal odour? 1 – Yes 2 – No 9 – Don't Know ☐

16. Was there an odour to the baby ? 1 – Yes 2 – No 9 – Don't Know ☐

17. Was the child premature ? 1 – Yes 2 – No 9 – Don't Know ☐

18. If Q17 yes, how many months/weeks ? _____ Months _____ Weeks

19. Did the baby play or move in the womb before labor ? 1 – Yes 2 – No 9 – Don't Know ☐

20. If Q=19 No, did the baby breathe at all after delivery? 1 – Yes 2 – No 9 – Don't Know ☐

21. Was the baby dead at birth? 1 – Yes 2 – No 9 – Don't Know ☐

22. Did the umbilical cord come before the baby was born? 1 – Yes 2 – No 9 – Don't Know ☐

23. Did the child cry immediately after birth ? 1 – Yes 2 – No 9 – Don't Know ☐

24. Was the child able to breastfeed soon after birth? 1 – Yes 2 – No 9 – Don't Know ☐

25. If Q24 = no, was the problem with the child or the mother ? 1 – Child 2 – Mother 9 – Don't Know ☐

26. Was the child weighed after being born ? 1 – Yes 2 – No 9 – Don't Know ☐

27. If Q26=Yes, how much did the child weigh ? _____ Kgs

28. Were there any bruises or signs of injury on the child's body after birth or at all after delivery ? 1 – Yes 2 – No 9 – Don't Know ☐

29. What was the colour of the child's skin after being born ? 1 – Normal 2 – Purple 3 – Pale 9 – Don't Know ☐

30. Did the child's arms/legs have strength ? 1 – Yes 2 – No 9 – Don't Know ☐

31. Did the child have any malformation at birth ? 1 – Yes 2 – No 9 – Don't Know ☐

Ask these questions if the child was born alive. If the child was born dead, skip to section C. Still birth

32. Did the eye colour change to yellow (jaundice) ? 1 – Yes 2 – No 9 – Don't Know ☐

33. If Q32=Yes, how many days after being born ? _____ Days

34. Did the child have any problem with the umbilical cord ? 1 – Yes 2 – No 9 – Don't Know ☐

35. Did the child have a fever ? 1 – Yes 2 – No 9 – Don't Know ☐

36. If Q35=yes, for how many days ? _____ Days

37. Did the child have convulsions ? 1 – Yes 2 – No 9 – Don't Know ☐

38. During the period of illness did he/she have areas of skin that were red peeling or skin rash with blisters containing pus ? 1 – Yes 2 – No 9 – Don't Know ☐

39. Was the child coughing ? 1 – Yes 2 – No 9 – Don't Know ☐

40. If Q.39=yes, for how many days _____ Days

41. Did the child have difficulty in breathing ? 1 – Yes 2 – No 9 – Don't Know ☐

42. If Q.41=yes, for how many days ? _____ Days

43. If yes, did he/she have fast breathing ? 1 – Yes 2 – No 9 – Don't Know ☐

44. If Q.43= yes, for how many days ? _____ Days

45. Did he/she have indrawing of the chest while breathing ? 1 – Yes 2 – No 9 – Don't Know ☐

46. If Q.45=yes, for how many days _____ Days

47. Was the child vomiting ? 1 – Yes 2 – No 9 – Don't Know ☐

48. If Q.47=yes, how many days _____ Days

49. Did he/she have diarrhoea? 1 – Yes 2 – No 9 – Don't Know ☐

50. If Q.49=yes, for how many days _____ Days

51. Was the child unable to breastfeed when he/she was ill ? 1 – Yes 2 – No 9 – Don't Know ☐

52. If Q.51 = yes, for how many days ? _____ Days

53. Was there a bulge in the child's fontanel ? 1 – Yes 2 – No 9 – Don't Know ☐

54. If Q.53=yes, for how many days ? _____ Days

55. Did the child have 1 – Injury 2 – Accident 3 – Neither 9 – Don't know ☐

56. If Q.55 is 1 or 2, what kind of injury of accident? _____

57. During the illness that led to death, did the child become unconscious ? 1 – Yes 2 – No 9 – Don't Know ☐

58. Did the health care worker tell you the cause of death ? 1 – Yes 2 – No 9 – Don't Know ☐

59. If Q.58=yes, what did she or he say ?

60. What do you think was the cause of death ?

C. Still births. Complete this section only for babies born dead.

1. If child was a multiple was this first, second ? — 1 – First; 2 – Second ☐
2. Did any of the following occur during labor or delivery? (Circle all that apply) — 1-Fever during labor; 2-Abd. pain; 3-Heavy bleeding; 4-Umbilical cord prolapse; 5-Breech presentation; 6-Delivered feet first; 7-Retained placenta; 8-Other _____ ☐
3. When did you last feel the baby move ? (before Del.) — a. ____ hrs; b. ____ days
4. How much time did the labor and delivery take ? — _____ hrs
5. Was anything done to try to help the baby breathe ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
6. Did the mother have syphilis prior to or since the delivery ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
7. If Q.6 =yes, did you receive antibiotics for this ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
8. Was the mother diagnosed with malaria prior to or since the delivery ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
9. Was the baby's body macerated (skin and tissue was pulpy and peeling) ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
10. What do you think was the cause of still birth ? ☐

D. Appearance (Show Pictures)

1. The size of the baby was like that of which one of the babies shown in this photograph ? (Circle one) — 1 – Tiny / small; 2 – Small than usual; 3 – About average; 4 – Larger than usual; 5 – Don't know /refused ☐
2. Was the head size very small at the time of birth (Anencephaly)? (Show photo) — 1 – Yes; 2 – No; 9 – Don't Know ☐

Show pictures for Q.3 – Q.7, if malformation (Section B)

3. Was there a mass, defect or opening on the back of the head or spine (meningomyelocele) ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
4. Was there any cleft lip or palate ? — 1 – Yes; 2 – No; 9 – Don't Know ☐
5. Were there any other limb defects ? — 1 – Yes; 2 – No; 9 – Don't Know ☐

ADDITIONAL INFORMATION

I. B. Information about the pregnancy

1. Estimated period of gestation (in weeks) ☐

LMP ☐☐☐☐☐☐ EDD ☐☐☐☐☐☐

Gravida ☐ Para ☐ Living ☐ Abortion ☐

2. Was this pregnancy ☐

   a. Single gestation b. Multiple gestation

3. Was the woman admitted to hospital for preeclampsia ? ☐

   a. Yes b. No

4. Did the woman develop eclamptic fit ? ☐

   a. Yes b. No

5. If yes, how many times ☐
6. When did it occur ? ☐

   a. Antepartum b. Intrapartum

7. When was the woman's last prenatal visit ☐

   a. Within one week b. With in one month c. More than one month

8. How many ultrasonography has the woman underwent ? ☐
9. When was the last ultrasonography done ? ☐

   a. Within 15 days b. Within one month c. More than one month back

10. Is the report available ? ☐

    a. Yes b. No

11. If yes, mention the last ultrasonography report

    ☐

12. Was woman anaemic Hb < 8 gm% ? ☐

    a. Yes b. No

13. Did woman had antepartum haemorrhage during this pregnancy ? ☐

    a. Yes b. No

14. If yes diagnosed to have ☐

    a. Placenta previa b. Abruptio c. Unknown

15. Woman diagnosed to have chorioamnionitis ? ☐

    a. Yes b. No

16. Was the fetal heart sound present at admission ? ☐

    a. Yes b. No

17. If no was it confirmed by ultrasonography ? ☐

    a. Yes b. No

18. In twins were the both fetal heart sounds present ? ☐

    a. Yes b. No

19. If no was it confirmed by ultrasonography ? ☐

    a. Yes b. No

20. What was woman's BP on admission (in mm Hg) ? ☐☐☐ / ☐☐☐

21. What was the pulse rate (in Minutes) ? ☐☐☐

B. Information about previous pregnancy

	Previous Pregnancies							
	First	**Second**	**Third**	**Fourth**	**Fifth**			
Year								
Duration of pregnancy (in months)								
Method of delivery (Vaginal -1, Assisted-2, Cesarean-3)								
Outcome (Still birth-1, Live birth-2, MTP-3, Ectopic-4)								
Place of delivery (Hospital – 1, Home – 2)								
Newborn weight (In Kg) (Small-1, Normal-2, Don't Know-3)								
Sex (Male-1, Female-2)								
Alive (Yes-1, No-2)								
Age of the child (in years) (Not applicable-1)								
Maternal complications (Anaemia-1, APH-2, PIH-3, Others-4, Nil-5)								
Complications of the baby during neonatal period (1-28 days) (Hospital admission-1, Fever-2, Diformity-3, Respiratory distress-4, Death-5, Others-6, Nil-7, Not applicable – 8)								

C. Information on labour

1. Date and time when labour pain started

   Date: ☐☐☐☐☐☐ Time: ☐☐ : ☐☐ AM/PM

2. Whether membranes were intact ? ☐

   a. Yes b. No

If no, whether it was, ☐

a. Spontaneous rupture of membranes b. ARM

3. Was the liquor meconium stained ? ☐

a. Yes b. No

4. What was the type of delivery ☐

a. Spontaneous b. Induced

5. What was the method of delivery ☐

a. Vaginal delivery b. Instrumental delivery c. Emergency LSCS d. Elective LSCS

6. What was the presenting part when the baby was delivered ☐

a. Vertex b. Breech c. Shoulder d. Face e. Others

7. Was episiotomy given ? ☐

a. Yes b. No

8. If delivery not spontaneous, indication for assistance ☐

a. Cord prolapse b. Passage of meconium c. Fetal distres d. Maternal distress e. Severe PIH f. Delay in 2^{nd} stage of labour g. Others

If others specify; _____

9. Outcome of the delivery ☐

a. MSB b. FSB c. Live birth

10. Did the baby cry immediately after birth ? ☐

a. Yes b. No

11. If no, did the baby cry after resuscitation ? ☐

a. Yes b. No

12. How was the placenta ☐

a. Complete, healthy b. Complete, calcified c. Infarction d. Others

13. Weight of the baby (in Kgs) ☐

14. Sex of the baby ☐

a. Male b. Female

15. Was the baby ☐

a. Term b. Preterm

If still birth;

16. When did the fetal death occur ? ☐

    a. Before onset of labour b. during labour

17. If the child was multiple was this ☐

    a. First b. Second c. Others

18. Was there any visible congenital abnormalities seen ? ☐

    a. Yes b. No

    If yes describe briefly _____

19. Was the baby and the placenta sent for autopsy ? ☐

    a. Yes b. No

    Cause of stillbirth: _____

II. If live birth (To be completed by neonatologist);

20. Did the baby breast feed after delivery ? ☐

    a. Yes b. No

21. When was the baby shifted to NICU after delivery ☐

    a. Immediately after birth b. Within 24 Hours c. More than 24 hours

22. Gestational age of the baby (In weeks) ☐☐

23. Weight of the baby (In gms) ☐☐☐☐

24. Did the baby have any infection ? ☐

    a. Yes b. No

    If yes, specify _____

25. Did the baby have convulsions ? ☐

    a. Yes b. No

    If yes how many times ? ☐

26. Was the baby small for gestational age ? ☐

    a. Yes b. No

27. Did the baby have respiratory distress syndrome ? ☐

    a. Yes b. No

28. Did the baby have meconium aspiration syndrome ? ☐

    a. Yes b. No

29. Was the baby given oxygen continuously in NICU ? ☐

a. Yes b. No

30. Did the baby need ventilatory support ? ☐

a. Yes b. No

31. Was the baby given any medications ? ☐

a. Yes b. No

If yes;

a. Antibiotics b. Anticonvulsions c. Ionotropics ☐

d. A & B e. All the above f. Other

If others Specify; _____

32. Was the baby given direct breast milk ? ☐

a. Yes b. No

33. Was the baby given expressed breast milk ? ☐

a. Yes b. No

34. When did the baby die ? ☐

a. 1st Day b. 2nd Day c. 3rd Day d. 4th Day

e. 5th Day f. 6th Day g. 7th Day

35. Was the baby sent for autopsy ? ☐

a. Yes b. No

36. Cause of early neonatal death; _____

Signature of Neonatologist: _____

This form is to assign cause of death

1. Was death a still birth or early neonatal death ? (Check one)

    a. Still birth ☐

    If Still birth, were there signs of maceration ? Yes /

    No

    b. Neonatal death ☐

2. Maternal cause (Mark One)

    (underlying cause of death)

    a. Antepartum haemorrhage ☐

    b. Infection / Sepsis ☐

    c. Preterm delivery ☐

    d. Accident ☐

    e. Obstructed labor ☐

    f. Multiple delivery ☐

    g. Hypertensive disorder / eclampsia ☐

    h. Unknown / no cause ☐

    i. Other (Specify) ☐

3. Fetus / neonatal cause (Mark one)

    (Underlying cause of death)

    a. Preterm / complications of prematurity ☐

    b. Infection/sepsis/pneumonia ☐

    c. Birth asphyxia ☐

    d. Congenital malformation ☐

    e. Birth trauma (during labor) ☐

f. Fetal trauma ☐

g. Tetanus ☐

h. Diarrhoea ☐

i. Hypothermia ☐

j. Low birth weight ☐

k. Jaundice ☐

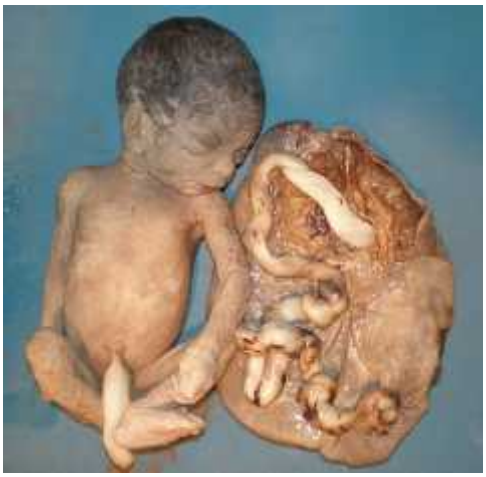
l. Unknown / No cause ☐

m. Other (Specify) ☐

4. Other comments

Signature of the investigator _____

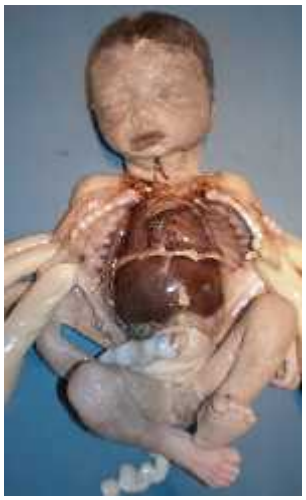
ANNEXURE III - PHOTOGRAPHS



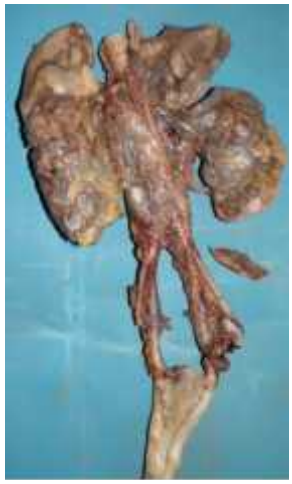
Photograph 2: Fresh Stillbirth with placenta

Photograph 3: Stillbirth with multiple congenital anomaly

Photograph 4: Nonimmune hydrops



Photograph 5: Pathological autopsy of a stillbirth



Photgraph 6: Polycystic kidney on pathological autopsy

Photograph 7: Cut section of polycystic kidney on pathological autopsy

ANNEXURE IV

KEY TO MASTER CHART

APH	–	Antepartum haemorrhage
CNS	–	Central nervous system
CVS	–	Cardiovascular system
DBP	–	Diastolic blood pressure
DM	–	Diabetes mellitus
END	–	Early neonatal death
FSB	–	Fresh stillbirths
IP. No.	–	In patient number
IUGR	–	Intrauterine growth restriction
MSB	–	Macerated stillbirths
N	–	No
PIH	–	Pregnancy induced hypertension
R	–	Registered
RS	–	Respiratory system
SBP	–	Systolic blood pressure
UR	–	Unregistered
Y	–	Yes

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY													
																												Placenta				Congenital malformation									
Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA001	254586	21	UR	MSB	42	2	1	1	2300	130	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA002	254581	21	UR	FSB	30	2	1	0	1300	116	60	N	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	Cord prolapse	N	N	N	N	N	Y	N	N	N	N	Y	N	N
BVA003	254299	22	UR	MSB	36	3	2	1	2500	130	90	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Gestational Diabetes	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA004	254154	21	R	END	35	3	1	0	900	130	70	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	Complications of Prematurity	-	-	N	N	N	N	N	N	N	N	N	N	N
BVA005	255003	22	UR	FSB	39	1	0	0	3500	150	90	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Jaundice, Viral Hepatitis	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA006	255790	25	UR	FSB	35	3	2	1	2000	100	70	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA007	255921	24	UR	MSB	30	2	1	0	1250	160	100	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	N	N	N	N	N	Y	N	N	Y	Y
BVA008	256728	24	R	MSB	36	2	1	0	1600	180	120	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA009	256794	26	R	FSB	35	4	3	3	1200	200	140	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	N	Y
BVA010	257318	22	UR	FSB	30	2	1	1	2250	110	70	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA011	257838	19	UR	FSB	28	2	1	0	500	130	90	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe IUGR	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA012	258483	22	R	FSB	31	3	2	2	2000	130	84	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA013	259086	25	UR	FSB	28	3	2	2	1000	136	84	N	N	N	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA014	259192	24	UR	FSB	30	1	0	0	850	110	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA015	259161	28	UR	END	34	4	3	1	1400	200	110	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	Complications of Prematurity	-	-	N	N	N	N	N	N	N	N	N	N	N
BVA016	260083	30	UR	FSB	32	1	0	0	1400	120	82	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	Preterm labour	N	N	N	N	N	N	N	Y	N	N	N	N	N
BVA017	260783	21	UR	FSB	32	1	0	0	1500	160	100	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA018	261733	22	R	MSB	34	1	0	0	2100	128	74	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA019	263208	19	UR	MSB	40	1	0	0	350	110	80	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA020	263247	20	R	FSB	38	3	0	0	2400	160	100	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA021	263915	22	UR	FSB	32	1	0	0	1000	160	100	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA022	264219	22	UR	FSB	29	2	1	1	1600	120	70	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY													
																												Placenta				Congenital malformation									
Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA023	264001	26	R	FSB	28	2	1	1	900	170	110	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	Y	N	N	N	N	N	N	N	Y	Y
BVA024	264311	28	UR	FSB	28	1	0	0	900	180	120	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA025	264398	29	UR	MSB	29	3	2	2	1400	120	90	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	N	N	N	N	Y	N	N	N	N	N	N	N
BVA026	265030	20	UR	MSB	29	1	0	0	250	130	80	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA027	264883	25	UR	FSB	33	1	0	0	1900	130	80	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	Birth asphyxia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA028	265849	19	R	FSB	29	1	0	0	1300	120	70	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Congenital anomalies	N	N	N	N	N	N	N	Y	N	N	N	Y	N
BVA029	266375	22	R	MSB	38	2	1	1	2250	120	84	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA030	266168	18	UR	FSB	28	1	0	0	700	150	94	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	Y	N	N	N	N	N	N	N	Y	Y
BVA031	266324	29	UR	MSB	32	2	1	1	800	156	100	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA032	267099	29	UR	MSB	31	4	3	3	1100	150	100	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA033	266884	35	UR	MSB	33	1	0	0	1100	180	120	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA034	267257	26	R	MSB	34	1	0	0	2500	150	90	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA035	268992	21	UR	FSB	29	1	0	0	1100	180	130	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA036	269055	22	UR	FSB	30	2	1	1	1250	120	70	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA037	270566	26	R	FSB	36	1	0	0	2500	170	110	Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Severe preeclampsia	Y	N	N	N	Y	N	N	N	Y	N	N	Y	Y
BVA038	271053	30	UR	FSB	31	2	1	1	1450	120	60	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA039	270832	24	UR	FSB	28	1	0	0	1250	140	80	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Congenital anomaly	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y
BVA040	271093	23	R	MSB	39	1	0	0	2600	110	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Cord prolapse	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA041	271131	22	UR	FSB	33	1	0	0	1400	160	110	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA042	271168	23	UR	FSB	28	5	2	2	800	120	80	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Congenital anomaly	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y
BVA043	271185	18	UR	FSB	31	1	0	0	1200	170	130	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Eclampsia	N	N	N	N	N	N	N	N	N	N	N	Y	Y

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY													
																												Placenta				Congenital malformation									
Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA044	271420	31	UR	FSB	28	3	2	2	1500	180	120	Y	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA045	271225	20	UR	MSB	28	1	0	0	300	110	70	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	Y	N	N	Y	N	N	N	N	N	N	N	Y	N
BVA046	273050	30	UR	FSB	36	2	1	1	2400	110	60	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Infection(Jaundice, Viral Hepatitis)	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA047	273523	22	UR	FSB	36	1	0	0	1750	130	84	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA048	279011	25	R	FSB	33	1	0	0	2250	150	90	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	Birth asphyxia	Y	N	N	N	N	N	N	N	N	N	N	Y	N
BVA049	274160	22	R	FSB	39	1	0	0	3400	120	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA050	274655	30	UR	FSB	36	4	3	3	2800	130	94	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	Maternal sepsis	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA051	275418	26	UR	FSB	31	3	2	1	1000	120	70	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA052	275657	25	R	FSB	32	3	2	2	1250	110	70	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	Congenital anomaly	N	N	N	N	Y	N	Y	N	Y	N	Y	Y	Y
BVA053	276761	20	R	FSB	40	1	0	0	2750	116	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	Y	N	N	N	N	N
BVA054	276998	25	UR	END	32	2	1	1	2000	110	70	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	Multiple lethal congenital anomalies	N	Y	Y	N	Y	N	N	Y	Y	N	N	Y	Y
BVA055	278106	18	UR	FSB	30	1	0	0	1500	120	80	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	Birth asphyxia	N	Y	Y	N	N	N	Y	Y	Y	N	Y	Y	N
BVA056	278244	22	UR	FSB	36	2	1	1	1400	100	60	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	Infection (Malaria)	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA057	278664	20	UR	FSB	38	1	0	0	2900	130	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA058	278703	26	UR	FSB	37	3	1	1	3000	140	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA059	278870	34	UR	FSB	38	1	0	0	2700	130	90	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA060	279872	28	R	MSB	31	5	4	0	1000	190	130	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA061	281922	21	R	FSB	30	2	1	0	1400	180	110	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA062	283277	27	UR	FSB	41	3	2	2	1500	130	80	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	Cord prolapse	N	Y	Y	N	N	N	N	N	N	N	N	Y	Y
BVA063	283285	20	R	FSB	28	1	0	0	1000	120	84	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Congenital anomaly	N	N	N	N	Y	N	N	N	N	N	N	Y	Y
BVA064	286627	20	UR	MSB	34	1	0	0	1500	130	80	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	Gestational Diabetes	N	N	N	N	N	N	N	N	N	N	N	N	N

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY													
																												Placenta				Congenital malformation									
Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA065	284222	22	R	MSB	40	2	1	1	1750	140	80	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA066	284894	22	UR	FSB	28	3	2	2	800	120	80	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA067	284897	20	R	FSB	33	2	1	1	1700	190	110	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA068	285620	22	UR	FSB	35	1	0	0	1500	180	94	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe preeclampsia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA069	285752	27	UR	MSB	37	3	2	2	2000	110	80	N	N	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA070	285845	24	UR	FSB	30	2	0	0	1150	130	80	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA071	287410	22	UR	MSB	38	1	0	0	2500	130	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA072	287463	22	UR	MSB	38	1	0	0	2200	150	100	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA073	287461	24	UR	MSB	29	7	3	0	700	160	100	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe Preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA074	287733	30	UR	FSB	35	3	2	2	2250	110	70	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA075	287211	23	UR	MSB	31	1	0	0	500	110	70	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe IUGR	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA076	288038	23	R	FSB	34	2	1	1	1800	120	80	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA077	288704	19	UR	MSB	41	1	0	0	2500	110	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA078	289620	20	UR	FSB	28	1	0	0	1200	110	70	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	Y	N	N	N	N	N	N	N	Y	Y
BVA079	289808	21	UR	MSB	29	1	0	0	900	140	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	Y	N	N	N	N	N	N	N	N	N	N	Y	N
BVA080	289674	30	UR	FSB	40	3	2	1	2850	170	100	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA081	290798	24	UR	MSB	37	4	1	0	1500	156	96	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA082	291062	30	UR	FSB	33	1	0	0	1350	112	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA083	291112	20	R	FSB	30	1	0	0	1200	110	70	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	N	N	N	N	N	N	N	N	N	N	N	N
BVA084	291945	23	UR	MSB	39	1	0	0	3000	130	68	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA085	291966	25	UR	MSB	31	1	0	0	600	110	70	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY													
																												Placenta				Congenital malformation									
Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA086	293796	18	UR	MSB	33	1	0	0	1800	130	90	Y	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA087	294248	22	R	FSB	34	1	0	0	2000	150	96	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	Y	N	N	N	N	N	N	N	Y	Y
BVA088	294520	27	UR	FSB	36	2	1	1	1500	150	120	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA089	294563	25	UR	FSB	32	1	0	0	1500	170	120	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Eclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA090	294503	20	UR	FSB	40	1	0	0	3500	170	70	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Birth asphyxia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA091	295847	27	UR	FSB	28	4	3	2	1100	110	70	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA092	295905	20	UR	FSB	28	3	2	0	400	120	70	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	Y	N	N	N	N	N	N	N	N	N	N	Y	N
BVA093	297136	28	UR	FSB	28	3	2	2	750	160	100	Y	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
BVA094	297461	19	UR	MSB	33	1	0	0	1500	120	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA095	298827	28	UR	MSB	33	2	1	0	1000	180	110	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA096	299565	26	UR	FSB	35	2	1	1	2000	120	70	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA097	302963	20	UR	MSB	40	1	0	0	1700	120	80	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA098	302935	30	UR	FSB	37	3	2	2	1750	180	120	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	Immune hydrops	Y	N	N	Y	N	N	N	N	N	N	N	Y	Y
BVA099	303778	20	UR	FSB	35	1	0	0	1500	120	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	Y	N	N	N	N	N	N	N	N	N	N	Y	N
BVA100	304502	26	UR	FSB	37	3	2	1	2300	100	60	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	Rupture uterus	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA101	304850	20	UR	MSB	33	1	0	0	1400	110	80	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Infection (Dengue)	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA102	305376	27	UR	FSB	31	4	3	1	1300	100	70	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA103	305396	25	UR	FSB	39	1	0	0	4500	150	90	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Birth asphyxia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA104	305401	25	UR	MSB	40	1	0	0	2500	130	80	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA105	305451	28	UR	FSB	35	5	4	2	2250	100	60	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	Y	N	N	N	Y	Y
BVA106	306627	27	UR	FSB	34	3	2	2	2250	110	70	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	Y	N	N	N	N	N	Y	N	N	N	Y	Y

VERBAL AUTOPSY																												PATHOLOGICAL AUTOPSY														
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Base identification number	IP. No.	Age (Years)	Registered / Unregistered	FSB/MSB/END	Gestational Age (Weeks)	Gravida	Para	Living	Birth weight (Grams)	SBP (mm Hg)	DBP (mm Hg)	Severe pre eclampsia	Eclampsia	DM	Anaemia	Placenta Pravia	Abruption	Multiple Gestation	Preterm labour	IUGR	Cord prolapase	Obstructed labour	Birth asphyxia	Congenital Anomalies	Maternal infection	Complications of Prematurity	Neonatal sepsis	Cause of death	PIH	APH	Others	Intrauterine Infection	CNS	CVS	RS	Uro Genital	Skeletal	Gastrointestinal	Others	Cause determined	Correlation with verbal autopsy
BVA107	307134	28	UR	FSB	36	2	1	1	1850	90	50	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	Abruption	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA108	307646	34	UR	FSB	31	3	1	0	800	90	50	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Placenta praevia	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA109	307931	25	UR	FSB	38	2	0	0	3000	170	110	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	Y	N	N	N	N	N	N	N	N	N	N	Y	N
BVA110	308537	20	UR	FSB	28	1	0	0	1000	110	70	N	N	N	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	Preterm labour	Y	N	N	N	Y	N	N	Y	N	N	N	Y	Y
BVA111	309111	25	UR	FSB	34	2	1	1	1500	180	106	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Severe preeclampsia	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
BVA112	313489	20	UR	FSB	32	1	0	0	1200	118	70	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N
BVA113	315004	25	UR	FSB	38	4	3	3	3100	110	70	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Unknown	N	N	N	N	N	N	N	N	N	N	N	N	N