Perinatal Services BC
Perinatal Mortality Guideline

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1. The Perinatal Mortality Review Process

The Perinatal Services BC (PSBC) Perinatal Mortality Guideline is designed to facilitate perinatal mortality review throughout British Columbia. Not all hospitals providing obstetric and newborn services in British Columbia have a functioning Perinatal Mortality Review Committee. In response to this, and to the many requests for assistance in the mortality review process from around the Province, PSBC formed the Subcommittee on Maternal and Perinatal Mortality. The objectives of this committee are to:

- facilitate maternal and perinatal mortality review being performed on a regular basis throughout the province,
- provide consultative advice to care providers and health authorities regarding the review process, as appropriate, and
- compile and review statistics on maternal and perinatal mortality.

PSBC promotes perinatal mortality review at the local level. If a facility has a very small number of perinatal deaths it may be appropriate for the review to be done at a regional or tertiary level. There may be situations when the local review committee may not be available to review a case or when the review committee may wish to consult further. In these situations, the case may be referred to a regional or tertiary care facility. To promote local and regional perinatal mortality review, a suggested *Terms of Reference for Hospital Perinatal Mortality Review Committees* is included.

A major part of perinatal mortality review involves the classification of perinatal deaths. To promote a systematic and standard classification and review process, the *Classification of Perinatal Deaths* section is divided into three parts and each part addresses one aspect of classification. These parts include Definitions, Group Classification of Perinatal Deaths, and Classifying Preventability. A Perinatal Mortality Form for classifying perinatal deaths is included as Appendix A. PSBC encourages that this form be completed for every perinatal mortality case at the time of the review.

Limited perinatal mortality data is collected through the BC Perinatal Data Registry (PDR) and Vital Statistics. Currently, only data from hospital deaths are collected. The data is used for surveillance and compilation of a regular BC Perinatal Mortality Report. Review of perinatal mortality data will facilitate identification of problems that may need local, regional, or provincial initiatives to improve quality of perinatal care.

This guideline is a compilation and update of five previous Perinatal Morbidity and Mortality guidelines:

- Hospital Perinatal Review Committee, 1999
- Clinical Examination of the Placenta, 1999
- Investigation and Assessment of Stillbirths, 2000
- Classification of Perinatal Deaths, 2000
- Perinatal Mortality Review Process, 2007

For information on the archived guidelines contact **psbc@phsa.ca**.

2. Investigation of Perinatal Deaths

Definitions

Clinical Note: For the purposes of review of Perinatal Mortality, "Perinatal" will be defined as from greater than or equal to 20 weeks gestational age and less than 28 days of life.

There has been variation in the definition of perinatal mortality, both internationally and within North America. For consistency of data collection, PSBC promotes the use of definitions as outlined by the **British Columbia Vital Statistics Act.**[1] www.bclaws.ca/civix/document/id/complete/statreg/96479_01

Perinatal Period – from greater than or equal to 20 weeks gestation to 7 completed days of life.

Neonatal Period – from birth through to 28 days of life.

Early Neonatal Period – from birth through to the first 7 days of life.

Late Neonatal Period – from 8 days of life through to 28 days of life.

Post Neonatal Period – from 28 days of life through to 1 year (364 days).

Livebirth – the complete expulsion or extraction from its mother, irrespective of the duration of the pregnancy, of a product of conception in which, after the expulsion or extraction, there is any of: breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle, whether or not the umbilical cord has been cut or the placenta is attached.

Abortus – a fetus weighing less than or equal to 500 grams or having completed less than 20 weeks gestational age at the time of expulsion or removal from the uterus regardless of whether signs of life are present or not.

Stillbirth – The complete expulsion or extraction from its mother after at least 20 weeks of pregnancy, or after attaining a weight greater than or equal to 500 grams, of a product of conception in which, after the expulsion or extraction, there is no breathing, beating of the heart, pulsation of the umbilical cord, or unmistakable movement of voluntary muscle.

Neonatal Death – the death of a child up to and including 28 days of age.

Perinatal Death – pertaining to or occurring in the period shortly before, during or after birth, starting at greater than or equal to 20 weeks of gestation and ending 7 completed days after birth.

Gestational Age – Fetal age or duration of pregnancy measured from the first day of the last normal menstrual period, and expressed in completed days or weeks. Gestation may be determined from LMP, data from early ultrasound, or from combining the two. The current BC recommendation is to use the first ultrasound after 7 weeks gestation to date the pregnancy unless timed ovulation induction has occurred (PSBC Obstetrical Ultrasound Assessment Standard[2]). Determination of gestational age is best decided on a "case by case" basis by a Perinatal Mortality Review Committee.

Preterm – gestational age less than 37 weeks of pregnancy

Early Preterm – 20^{+0} weeks to $33^{+6/7}$ weeks

Late Preterm – 34^{+0} weeks to $36^{+6/7}$ weeks

Term – 37^{+0} weeks to $41^{+6/7}$ weeks

Post-term – gestational age of 42 weeks or more

2. Investigation of Perinatal Deaths, *cont'd.*

Classification of Perinatal Deaths and Use of the Perinatal Mortality Form

There are differing opinions regarding how perinatal deaths are best classified[3,4,5,6,7,8]. The original Aberdeen classification[3,9] emphasized maternal causes of perinatal death. Later Wigglesworth[10] and then others[5,6,7,8] advocated a pathophysiologic approach. More recent refinement of the pathophysiologic approach was presented by the American Congress and College of Obstetrics and Gynecology[11] and the Stillbirth Collaborative Research Network[12]. Both have been used and found to be helpful by one of the perinatal mortality review committees within the Provincial Services Health Authority (PHSA). In this guideline we categorize perinatal deaths into 4 groups using combined criteria.

The questions to be answered when determining the cause of death include:

1. To what group does a death belong i.e. what criteria define that group?
2. When did the death occur i.e. stillbirth or neonatal death?
3. How and why did the death occur?

There is a copy of the Perinatal Mortality Form in Appendix A. Please refer to it as you read through this section.

First, note whether a full or partial autopsy preceded the perinatal mortality review. Gestational age and gender are identified. For all cases, indicate if there is evidence of asphyxia or not (see Appendix B – SOGC Task Force on Cerebral Palsy and Neonatal Asphyxia[13]).

The following text guides the use of Parts I to IV of the Perinatal Mortality Form.

Part I. Group Classification

The major cause of death determines the group and the four groups are mutually exclusive.

Group 1: Lethal Congenital Anomaly (LCA)

A. Stillbirth greater than or equal to 500 grams or greater than or equal to 20 wks gestation
B. Neonatal Death

Note: Termination of pregnancy greater than 20 weeks gestational age are considered Group 1

Group 2: Stillbirth – greater than or equal to 500 grams or greater than or equal to 20 weeks gestation – Indicate degree of maceration

A. None – no signs of maceration, fresh stillbirth, implying intrapartum death.
B. Mild to Moderate – discolouration of umbilical cord, signs of skin slippage and bullae formation only. These cases have likely been dead in utero at least 6 hours, and in more extensive cases, over 24 hours.
C. Severe – bones are loosening and cranium collapsed. These cases have likely been retained in utero for days to weeks.

Group 3: Premature Deaths

A. Less than 28 weeks gestation or less than 1000 grams
B. Greater than or equal to 28 weeks gestation to less than 37 weeks and greater than or equal to 1000 grams ("premature")

Group 4: Term Deaths ≥ 37 weeks

Please check the appropriate box in Part I on the Perinatal Mortality Form.

Part II. Cause(s) of Death

Identify cause(s) of death and immediate antecedents and note these in Part II on the Perinatal Mortality Form.

2. Investigation of Perinatal Deaths, *cont'd.*

Part III. Other Significant Conditions Contributing to the Death

Other significant conditions or contributory factors implicated in a death should be identified, if possible. Any of these will usually fall within a variety of group headings. The group headings and a variety of examples of contributory factors follow:

Group Headings	Examples
Maternal	Severe preeclampsia, maternal heart disease, substance use
Placenta/cord	Amniotic bands, significant cord accidents, abruptio placenta
Fetal	Genetic and chromosomal abnormalities, blood incompatibility, multiple pregnancy, IUGR
Neonatal	Cold stress, sepsis, SGA
Socioeconomic	Poverty, poor antenatal care
Unexplained	
Other	Infections, trauma

Please check the appropriate box in Part III on the Perinatal Mortality Form if applicable, and identify in text the specific contributory factors.

Part IV. Specify Preventability

When reviewing a perinatal death, the determination of "preventability" has relevance. Such analysis can lead to improvements in perinatal care; it also permits prediction of implementable and/or ideal perinatal mortality rates. Be assured that any commentary or classification in this or any other part of the form is protected under s. 51 of the *Evidence Act* and thus is immune from disclosure. Also, any use of this data to compile overall statistics will remain confidential. Classify preventability as non-preventable, possibly preventable, or ideally preventable. This classification of preventability is adapted from the *Alberta Perinatal and Neonatal Statistics & Maternal Mortality Annual Report, 1994 (1996).*[14]

1. Not Preventable

All the following criteria have to apply for a death to be classified as non-preventable.

- Prenatal care and fetal surveillance were adequate and appropriate
- Intervention was available, accessible, appropriate and timely
- Circumstances surrounding a death were not preventable
- All standards of care were met

2. Possibly Preventable

Unrecognized but detectable fetal or newborn compromise:

- Not detected or not appreciated
- Inappropriate, inadequate or untimely intervention
- One or more standards of care may not have been met

2. Investigation of Perinatal Deaths, *cont'd.*

3. Ideally Preventable

- A sudden, compromising event for the fetus or newborn where intervention was not possible on this occasion
- Geographic isolation where resources necessary for management were not available
- Patient choice to decline necessary treatment or intervention
- All standards of care were met

3. Investigation and Assessment of Stillbirth

Introduction

In Canada, stillbirths include all fetal deaths with a birth weight of at least 500 g or a gestational age at delivery of at least 20 weeks (irrespective of the timing of the fetal death or whether the death occurred as a result of pregnancy termination).

At a Canada wide meeting in late 2015, consensus was reached that this definition required revision.[15] Among the reasons is that stillbirth and termination of pregnancy have vastly differing epidemiology and inform public health in different ways.

A total of 461,083 live births and 3,991 stillbirths were registered in British Columbia between 2000 and 2010. But the overall stillbirth rate increased by 31% (95% CI 13% to 50%), from 8.08 per 1000 total births in 2000 to 10.55 per 1000 in 2010. During this interval, the total stillbirth rate increased but the spontaneous stillbirth rate decreased non-significantly. This increase in total stillbirth rate was secondary to an increase in terminations of pregnancies.[16]

This increase in stillbirths due to pregnancy termination was accompanied by a simultaneous decrease in the prevalence of congenital anomalies among live-born infants. This may suggest that advances in prenatal screening and diagnosis have been the underlying stimulus for these changes. Neonatal and infant deaths as well as late stillbirths from major congenital anomalies are being replaced by earlier terminations of pregnancy. The spontaneous stillbirth rate later in pregnancy has not decreased substantially. This may be attributable to advanced maternal age associated with chronic diseases (hypertension, diabetes), as well as higher pre pregnancy BMI, and multiple births, all of which are independent risk factors for stillbirth.

This guideline provides a suggested protocol for the assessment of a stillbirth, using materials and algorithms modified from the American College of Obstetricians and Gynecologists[10], the Stillbirth Collaborative Research Network[17], the stillbirth classification of the National Institute of Child Health and Human Development Workshop on Stillbirth[18], and the Queensland Maternity and Neonatal Clinical guidelines on Stillbirth Care.[19]

We recognize that each stillbirth can contain circumstances that may modify the implementation of these procedures, limit the relevance of one or more of the procedures recommended, or require specific additional areas of investigation. However, this guideline has been created **to identify a comprehensive evidence based approach to the investigation of a stillbirth.** The best results will be attained when the investigation can be as complete as possible. The information obtained will:

- assist in discussions with the parents,
- assist in the planning of future perinatal care for the family, and
- contribute to the understanding of fetal demise.

Collectively, an increase in our body of knowledge may help to prevent future pregnancy loss and assist other parents in a similar situation.

Stillbirth is an explicable event, where a probable or possible cause of death can confidently be assigned in the majority of cases. The experience of the BC Women's Hospital Perinatal Mortality Review Committee would support this. In a ten year review of greater than 400 spontaneous stillbirths, a cause of death could not be ascertained in 15%. Where an underlying cause of death could be determined, the distribution was approximately as follows: major placental event (40%), cord accident (15%), congenital anomaly (15%) and intrauterine infection (15%).[20]

This guideline outlines the steps in the investigation of a stillbirth. These steps are presented as a checklist tool to facilitate use in the clinical setting. The goal is that all relevant information be collected at the appropriate time and that the information is directed to the pathologist so that a complete post mortem investigation can be completed.

3. Investigation and Assessment of Stillbirth, *cont'd.*

The guideline also includes sections on:

- clinical external stillbirth examination at the time of delivery,
- stillbirth autopsy and request;
- information for practitioners,
- autopsy information for parents,
- clinical photographs of stillbirths,
- radiologic studies of stillbirths,
- cytogenetic studies in stillbirth investigations
- information on the cytogenetic laboratories in British Columbia.

We suggest that the checklist tool for the investigation of stillbirths and the autopsy information for parents be photocopied and added to the "stillbirth" form packets that many hospitals utilize. We also encourage that the cytogenetic laboratories listed be used as a resource should any specific questions arise in relation to the investigation of a stillbirth.

3. Investigation and Assessment of Stillbirth, *cont'd.*

Overview: Considerations in Stillbirth Evaluation and Care Checklist

1. At Diagnosis

- ☐ Review of all documentation relevant to current pregnancy:
  - Antenatal Record, parts 1 and 2
  - Laboratory investigations including serum screening
  - Ultrasound(s)
  - Past obstetrical history
  - Medical history
- ☐ Laboratory:
  - CBC, type/screen*
  - Feto-maternal hemorrhage screen*
  - Serology for CMV, toxoplasmosis, parvovirus B19, HSV, rubella (if not previously done)
- ☐ Discuss birth plan.
- ☐ Vaginal birth is preferable if there is no contraindication.
- ☐ Consider method of induction in light of clinical circumstances.
- ☐ Discuss role of autopsy (complete, limited or external exam only) and alternatives such as imaging.
- ☐ Discuss role of placental pathology.
- ☐ Offer grief support using appropriate resources.

2. At the Time of Delivery

- ☐ Examination of the stillborn: external exam by care giver, or specialist if available.
- ☐ Gross examination of placenta: weight, appearance, cord length and appearance, coiling ratio, particularly if placental pathology will not be done.
- ☐ Obtain informed consent/refusal for autopsy.
- ☐ Submit placenta for pathology.
- ☐ Cytogenetic studies (karyotype, FISH, CGH, microarray): newborn tissue, cord or placenta.*
- ☐ Additional laboratory testing based on clinical circumstances:
  - Coagulation profile*
  - Toxicology screen*
  - Cultures of stillborn and placenta/amnion*
  - Thrombophilia testing
  - Hemoglobinopathy screen if not already done
  - HgbA1c
  - Hypertensive disease labs

3. Post Partum Considerations

- ☐ Facilitate creation of memories, and seeing/holding the stillborn infant, if desired by parents.
- ☐ Arrange for follow up or referral, recognizing that autopsy and other investigation results may not be complete for up to 3 months.
- ☐ Provide information on contraception and prophylaxis before future conception.
- ☐ Offer advice on milk suppression or donation to the milk bank if requested.
- ☐ Discuss information on funeral arrangements and legal documents.

*** These tests are time sensitive and should be performed as soon as possible.**

3. Investigation and Assessment of Stillbirth, *cont'd.*

Laboratory Investigations in Stillbirth

1. Universal	*Notes*
▪ CBC*	
▪ Group and screen*	
▪ Screen for fetal maternal hemorrhage*	
▪ Serology ▪ CMV IgG and IgM ▪ Toxoplasmosis IgG and IgM ▪ Parvovirus B19 IgG and IgM ▪ HSV IgG and IgM ▪ Rubella IgG and IGM	
2. Selected Cases	
▪ Thrombophilia testing ▪ IgG anticardiolipin ▪ IgG anti-beta 2-glycoprotein-I	Only IgG ACA and IgG anti-beta 2 - glycoprotein I antibodies are associated with stillbirth. Hereditary thrombophilias are not associated with stillbirth. Testing is appropriate if the stillbirth appears to be due to a major placental event (IUGR or SGA <5th percentile, pathologic evidence of placental insufficiency, placental weight <3rd percentile for GA). Antibody levels are affected by proximity to pregnancy, and should be deferred to 3 months postpartum, with confirmation of elevated levels 3 months later. Antibody levels should be elevated to >95th percentile or 3 multiples of median to be considered significant.
▪ Coagulation profile*	If there is evidence of antepartum hemorrhage or DIC.
▪ Hemoglobinopathy screen	
▪ Toxicology screen*	Based on clinical circumstances, and with informed consent of the patient.
▪ HgbA1c	Stillbirth is unlikely to be associated with diabetes (pre-existing or gestational) in the absence of ketoacidosis, diabetic fetopathy, macrosomia with fetal trauma, or poor control with the majority of blood glucose levels >14 mmol/l.
▪ Hypertensive disease investigations	
▪ Cultures of stillborn and placenta or amnion*	Bacterial and viral cultures may be appropriate. Pathognomonic changes are identifiable at autopsy or on placental pathology.

Other investigations are unlikely to be helpful and should be based on the clinical circumstances.

* **These tests are time sensitive and should be performed as soon as possible.**

Clinical External Examination of the Stillborn at the Time of Delivery

A complete physical examination of the stillborn is a critical component of an etiologic investigation. This examination should be done at the time of delivery and can be done by the physician/midwife attending the mother, or other physician such as a pediatrician, if available. Where available, a medical geneticist may also be consulted.

This procedure should not take long to perform since most fetuses will exhibit few, if any, external anomalies. If any anomalies are recognized or suspected, they can be examined in greater detail. The examination should be documented on the Newborn Record Part I, Section 7 "Stillbirth" and Section 8 "Physical Examination" (including stillbirths).

The compiled list of external findings can be integrated with other relevant data (e.g. complete clinical history, ultrasonic, radiologic, microbiologic, cytogenetic findings, and autopsy results).

The examination of the stillborn can be divided into five segments, and each segment requires separate and systematic examination.

1. General

Global evaluation of the following parameters:

- State of preservation: fresh or macerated, degree of maceration, intact, evidence of interventions required to effect delivery
- Weight; estimate gestational age; size for gestational age
- Measurements: circumference of head, chest and abdomen; lengths of crown-heel (with leg fully extended), crown-rump and foot
- Colour: vernix white or meconium stained; any lesions of skin such as vesicles, bruising

2. Craniofacial

- General impression of normality or abnormality
- Quantitative relationships
  - As craniofacial height is roughly equal to the cranial vault height, abnormalities in the ratio indicate microcephaly or hydrocephaly
  - As the intercanthic distance is roughly equal to the orbit width, an abnormal ratio suggests hypo/hypertelorism
  - Abnormal ear location – normally external meatus lies above level of nostrils and long axis of the ear is nearly vertical
- Specific structural anomalies
  - Anterior – flat nasal bridge; short flat nose; small eyes; epicanthal folds; cleft lip (uni/bilateral or median); cleft palate; small mouth; down turning angles of mouth; glossoptosis and retro/prognathism
  - Posterior – anencephaly, anencephaly and encephalocele (usually occipital)

3. Neck

- Abnormally short
- Thickened nuchal fold and/or cystic hygroma
- Cervical rachischisis and meningomyelocele

3. Investigation and Assessment of Stillbirth, *cont'd.*

4. Trunk

- Overview – presence of edema; abdominal distention and muscular development
- Specific structural anomalies
  - Ventral – omphalocele; umbilical hernia; gastroschisis; diastasis recti and prune belly
  - Dorsal – rachischisis; meningocele and meningomyelocele
  - Cord Insertion – normal location; number of vessels and juxtafetal cord coarctation with abnormally thin umbilical ring
  - External Genitalia – absent; ambiguous and small or enlarged structures (penis, scrotum, clitoris, labia, vagina)
  - Anus – patency; imperforate; stenotic and displaced anteriorly

5. Extremities

- Overview – normal/abnormal length; shortening of particular segment and muscle development
- Specific structural anomalies
  - Upper – distortions; amputations; finger lengths; shape and size; poly/syndactyly and abnormal palmar creases
  - Lower – positional abnormalities of feet, toe lengths, shape and size; increased sandal space; poly/syndactyly and rocker-bottom deformity

Stillbirth Autopsy and Request: Information for Practitioners

What the Requesting Practitioner Can Expect From a Stillbirth Autopsy

A stillbirth autopsy is meant to examine for anatomical causes of death or disease states based on fetal and placental examination and may not be definitive in situations where the underlying cause is external to the fetus or placenta or a complete autopsy, which includes placental examination, cannot be performed.

Fetal and perinatal autopsies combine clinical information with findings from gross examination, microscopic examination, and other studies as indicated. The autopsy may identify a single cause of demise, a most likely cause of demise, multiple potential causes of demise, or may not be able to identify any potential cause of demise. The autopsy may also exclude possible causes of demise.

The autopsy pathologist will decide which procedures, investigations, and special tests are indicated based on the available clinical information at the time of autopsy, questions to be addressed as provided by the submitting practitioner, and findings during performance of the autopsy. Submitting practitioners are welcome to request special procedures and testing but will be required to provide a robust rationale if one is not apparent based on the available clinical and autopsy information.

A preliminary autopsy report may be issued, typically within 1 week of the date of autopsy, depending on gestational age at delivery. A typical stillbirth autopsy takes 2–3 months to complete, which reflects the sequential nature of autopsy workflow and the time required for testing at various stages. The autopsy may be completed sooner in situations where special testing is not required whereas it may take longer when multiple special tests are indicated or consultation with other medical professionals is required. The latter commonly occurs in the setting of complex genetic or metabolic abnormalities.

The autopsy pathologist may consult other pathologists or medical professionals with expertise in specific areas of stillbirth autopsy pathology. Common examples are examination of the brain by a neuropathologist or genetic testing by a clinical scientist. Information from these consultations will be included in the autopsy report at the discretion of the primary autopsy pathologist.

It is expected by the autopsy pathologist that the primary care physician or practitioner requesting the autopsy will review the autopsy results with the family. This is to allow combination of all factors and variables to be summarized and discussed with by one provider. As such, the practitioner reviewing the autopsy results with the family should expect a detailed autopsy report delivered in a timely fashion that explains relevant findings and addresses questions raised by the practitioner and family. The autopsy pathologist may also recommend referral to another medical professional for further investigation(s). The autopsy pathologist should be contacted with any questions or concerns related to a stillbirth autopsy report.

Considerations for the Practitioner Requesting a Stillbirth Autopsy

Coroner vs. medical stillbirth autopsy: Prior to submitting a request for autopsy, the practitioner should first consider whether the situation requires assessment by the coroner. Coroner jurisdiction is limited to liveborn infants and follows separate procedures that are not outlined in this document.

Who is responsible for the costs related to a stillbirth autopsy? The cost of the autopsy and most related studies is covered by the Medical Services Plan. Any special testing not covered by MSP will need to be arranged on an *ad hoc* basis with consultation between the relevant parties (e.g., special genetic testing). The cost of body transport for stillbirths 20 weeks and over (500 g and over in the absence of a gestational age) is not covered by the MSP and must be addressed by the family and referring institution.

Who performs a stillbirth autopsy? A pathologist with expertise in perinatal pathology will perform the stillbirth autopsy. Allied healthcare professionals, such as Pathology Assistants and Laboratory Technicians, will also be involved. Pathology Assistants with expertise in perinatal pathology may perform part or all of the autopsy under the guidance of the autopsy pathologist. At teaching hospitals, a resident physician or fellow may perform part or all of the autopsy under the guidance of the autopsy pathologist.

3. Investigation and Assessment of Stillbirth, *cont'd.*

Pathologists and other medical professionals with expertise in specific areas relevant to stillbirth autopsy pathology may also be involved at the discretion of the autopsy pathologist.

Autopsy documentation: Initiation of a stillbirth autopsy requires completion of the appropriate documents. Delivery at or over 20 weeks gestational age, *regardless of age of intrauterine demise and/or size and/or state of maceration,* requires consent for autopsy, registration of stillbirth, and appropriate documentation to facilitate disposal of remains. In the rare event that the gestational age is unknown, a fetal weight of 500 g or more requires consent for autopsy, registration of stillbirth, and appropriate documentation to facilitate disposal of remains. If there is any uncertainty as to which documents are required and/or how to complete them, the autopsy pathologist should be contacted for guidance.

Who can consent for an autopsy? The parents or legal guardians may provide consent for either a complete or limited autopsy. The placenta is typically examined as part of the autopsy; however, in the instance where consent for autopsy is not provided *and* the family is amenable to having the placental examined, the placenta may be submitted for examination as a surgical pathology specimen.

A stillbirth autopsy may be complete or limited:

1) Complete autopsy
    a. A complete autopsy will include:
        i. external examination
        ii. internal examination
        iii. microscopic examination
        iv. ancillary studies at the discretion of the autopsy pathologist
        v. retention of tissues for examination as necessary
2) Limited Autopsy:
    a. An autopsy may have restrictions and limitations at the discretion of the individual providing consent.
    b. It should be made clear to the individual providing autopsy consent that a limited autopsy will limit the ability to fully investigate the pathophysiology of a given disease state or potential cause of death.
    c. Any restrictions must clearly be described. Direct consultation with the autopsy pathologist may provide further guidance; however, the limitations must be documented on the autopsy consent form.
    d. In rare instances the autopsy pathologist or medical practitioner may refuse to perform all or part of a limited autopsy if the limitations imposed significantly inhibit the examination.

Clinical information and testing requests: The probability that a cause or potential causes of demise will be identified is dependent on many factors. One important factor is the provision of clinical history, which guides the approach to autopsy, provides indications for special testing, and helps formulate the final report. The autopsy pathologist will request clinical information from relevant sources; however, this information is typically not complete at the time of autopsy. The submitting practitioner should always provide pertinent clinical history with the request for autopsy.

The requesting practitioner, the family, and related members of the health care team may have other questions they would like addressed. It is important that the requesting practitioner communicate these questions to the autopsy pathologist with the request for autopsy.

In the setting of complicated or unusual situations, the requesting practitioner should consider directly contacting the autopsy pathologist to discuss the relevant information and question(s) to be answered,

3. Investigation and Assessment of Stillbirth, *cont'd.*

Submission for autopsy: Presently many special tests, including karyotyping and molecular studies, require unfixed non-degraded tissue. The following conditions may render tissue unsuitable for many special tests:

- Fixation in formalin or other fixative
- Prolonged immersion in saline or water
- Lack of prompt refrigeration

If a specimen cannot be refrigerated and/or transported in a timely manner, the autopsy pathologist should be contacted for further guidance.

The placenta is a critical component of a stillbirth autopsy and every effort should be made to obtain and submit it for examination.

How is a stillbirth autopsy performed? A general autopsy workflow is a dependent sequence of investigations as follows:

1) Review of autopsy documentation and available medical information
2) External examination:
    a. Document anthropomorphic measurements and comparison with sets of normative values
    b. Evaluate for dysmorphic features
    c. Photographs and radiographs as indicated
3) Internal examination:
    a. Standard Y or U-shaped incision to expose the thoracic, abdominal, and pelvic contents
    b. Tissue sampling for microbiological studies (if indicated)
    c. Examine internal organs *in situ*
    d. Remove the internal organs for individual assessment
    e. Weigh and measure all organs and compare with sets of normative values
    f. Sample organ tissue for microscopic and potential further studies including molecular testing (if indicated)
4) Return all unsampled tissues to body and release body per disposition request. Organs and tissues not returned to the body will be retained and disposed of according to hospital policy.
5) Issue preliminary autopsy report (if required)
6) Additional investigations:
    a. Neuropathological examination (if indicated; retention of brain and/or other tissues may be required)
    b. Review microscopic sections of organs with special histochemical stains or immunohistochemistry as indicated
    c. Request and review of special studies as indicated (e.g., karyotype, electron microscopy)
    d. Request for consultation with other pathologists and/or medical professionals as indicated
7) Consolidate findings and issue final autopsy report

Tissue retention: A full autopsy examination requires retention of some somatic and placental tissue. At the minimum this includes small samples of tissue for microscopic examination and special studies. Occasionally whole organs may need to be retained to facilitate examination. This is especially important in neuropathological examinations.

Studies initiated outside the autopsy process: Other practitioners may have performed studies regarding a stillbirth outside the autopsy. Common examples include serological, microbiological, or genetic tests. Although the autopsy pathologist will attempt to find and incorporate this information,

3. Investigation and Assessment of Stillbirth, *cont'd.*

it is important to recognize that outside studies may be not be documented in the available medical information or otherwise inaccessible to the autopsy pathologist. Moreover, not all outside studies may be deemed relevant.

What will the body look like after the autopsy? Performance of internal examination requires incisions the made in the chest and abdomen. If the brain and spinal cord are examined, incisions along the posterior hairline and over the spine may also be made. These standard incisions are closed by stitches upon completion of the autopsy and are specifically placed to be hidden by clothing in the event the family wishes to have an open casket funeral. In rare instances the need for an incision in a visible area may arise, such as sampling a skin lesion on the hand or face.

When will the report be ready and what will it include? This is covered above under what the submitting practitioner should expect. In the event that there is any apparent discrepancy, concern, or question regarding a preliminary or final autopsy report, the practitioner should contact the autopsy pathologist or autopsy department for further information.

Stillbirth Autopsy Information for Parents

Why is a stillbirth autopsy so important?

The autopsy is the careful examination of the stillborn baby's body after death. It is performed by a pathologist — a doctor with specialized training. The examination of babies who die is important for parents and family members for the following reasons:

- An autopsy is the best way possible to understand how and why your baby died. Although many tests are available to diagnose disease, no test can give a diagnosis with the same degree of certainty as an autopsy. In fact, it serves as a check on the tests themselves. An autopsy is also able to detect medical problems not shown by other types of examinations.
- An autopsy is done to discover whether the medical problem has any genetic (hereditary) importance especially if you are planning to have more children. Hereditary causes are also important information for brothers and sisters, and other family members of the baby who has died. The more complete the medical information available to you and your doctor, the better genetic counseling you will receive.
- The autopsy examination increases medical science's understanding of the disease from which the baby died. In this way, it improves the treatment and the chance of survival of other infants with similar problems.

An autopsy will not be performed without consent from the parent.

What does the autopsy examine?

An autopsy examines various body parts, tissues, and organs. The organs in the body all work together. When one organ is not functioning normally, it may cause problems in many others. It is important to understand how the problem has affected the body as a whole. This information is combined with information about the pregnancy, previous pregnancies and the general health of the mother and baby. Sometimes parents want only a partial autopsy done such as only on the heart. it is important that these wishes are discussed with the health care provider so they are recorded on the autopsy consent form. A partial autopsy will not provide the same level of information as a complete one.

Why are there so many forms to fill out?

You will need to complete some or all of the following forms, required by law, depending on the circumstances of the death.

1. **Registration of Stillbirth:** This form is required by law to record the places and causes of all stillbirths. This information helps us be alert to situations that may need investigation or areas for improved health care services. A section of this form is completed by the parent(s) and the remainder of the form is completed by the attending physician/coroner, and funeral director.
2. **Permission for autopsy:** A parent of the baby who died must sign a consent form before an autopsy can be done and will receive a copy of the signed consent form to keep. We would like parents to know that, in most circumstances, they can choose to refuse an autopsy [full or partial]. However, we hope that understanding the great benefits of an autopsy will help parents make the decision in favor of the post mortem examination. Some parents find it helpful to talk about the autopsy with their doctor, their religious advisor, a social worker or the pathologist who would be doing the examination. You are welcome to tell the doctor or any team member about any autopsy restrictions due to personal or cultural reasons. Some families request certain mementos such as special clothing to be left with the baby. The pathologist will willingly arrange this.
3. **The Hospital Release Form:** This form allows the Funeral Director of the parent's choice to take responsibility for transporting and caring for the baby's body as requested.

How long does an autopsy take and when will I receive the results?

A routine complete autopsy usually takes about 3 hours.

3. Investigation and Assessment of Stillbirth, *cont'd.*

The pathologist sends a preliminary report to your family doctor a few days after the examination. Later, a final report of all completed studies is also sent. Your doctor will contact you to come in and review the results together. The autopsy pathologist is also available if you have further questions.

Will there be any visible marks from the autopsy?

We want to assure parents that the body of their baby is treated with respect and dignity. Marks from the examination will not be visible when the baby is dressed. Face and hands are not involved in an autopsy. If you would like family or friends to view your child, you can feel comfortable arranging for this with the Funeral Director or Social Worker.

Will there be any extra cost for an autopsy?

For residents of British Columbia the cost of autopsy examination is covered by their Provincial Medical Plan.

Do you have any more questions?

If there are other questions or concerns, do not hesitate to ask your doctor or the nursing staff.

General autopsy information pamphlet is also available at
www.cw.bc.ca/library/pdf/pamphlets/CW020Autopsy_2015.pdf

Clinical Photographs in Stillbirth

Photographs of the stillborn are essential in the documentation of both normality and abnormality in conjunction with a descriptive physical examination. High quality medical photographs are preferred; however, any pictures are better than no pictures at all.

These photographs should be taken in addition to bereavement photographs, and should be adequately labeled and identified.

Photographs should include:

- AP view–whole body frontal including limbs
- PA view–whole body back including limbs
- Lateral view(s) of the face
- Frontal View — close up of face
- Photos of any abnormalities

Photographs should only be taken if consent has been received from the parent(s). The discussion around performing these studies should be documented on the patient care record.

Imaging Studies in Stillbirth

1. Radiographs

Radiographs of stillborns are useful in detecting and documenting abnormalities (primarily skeletal) which may not be detected on cursory physical examination.

Investigation should include:

- AP plain radiograph of the whole body. The limbs should be straightened as much as possible and, if possible, placed in anatomic position resulting in AP views of both the arms and the legs. The head and all limbs including hands and feet should be included.
- Lateral view of the skull.
- If structural abnormalities are present, separate films should be taken of the abnormal parts.
- More detailed films will be helpful if the stillborn has obvious skeletal dysplasia, including AP and lateral of all limbs and AP of the hands and lateral spine.

2. Ultrasonography

Antepartum ultrasound reports should be provided for the investigation of the stillborn. These should document any noted anomalies, fetal weight, amniotic fluid, and placental abnormalities.

It may be of benefit to perform an antenatal ultrasound prior to delivery of the stillborn.

Postmortem ultrasonography, where available, may be useful when the family does not consent to a full autopsy.

3. CT or MRI

These may have a limited role and should be at the discretion of the pathologist and radiologist.

Imaging studies should only be taken if consent has been received from the parent(s). The discussion around performing these studies should be documented on the patient care record.

Cytogenetic Studies in Stillbirth Investigation

1. Cord Blood for Cytogenetic Studies

A cord blood sample for cytogenetic studies should be collected after delivery on all stillborns. The specimen should be stored until the clinician or pathologist decides if the specimen will be sent for cytogenetic studies.

To Collect: Using sterile technique, obtain 1-10 ml of cord blood as soon after delivery as possible, and place in a heparinized green topped tube. LABEL by handwriting baby's name, hospital number and indicate "stillbirth".

To Store: Store at room temperature until shipped. Do not freeze.

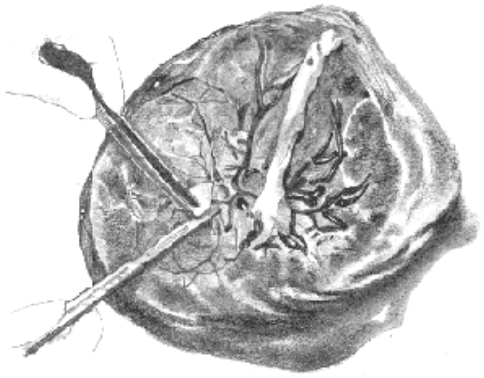
To Send: Send the cord blood sample collection to the genetics laboratory as soon as possible (appropriate timing should be determined locally in conjunction with the genetics laboratory).

2. Placental Sampling for Cytogenetic Studies

(See PSBC Guideline 4 – Examination of the Placenta)

Following delivery of the placenta and prior to sending the placenta to pathology, a sample of placenta tissue should be collected on all stillborns and stored until the clinician or pathologist decides if the specimen will be sent for cytogenetic studies.

To Collect: Collect the placenta tissue sample from the fetal side by the site of cord insertion beneath the amnion as illustrated at right. Remove 1 cm^3 of placenta tissue with a sterile surgical knife and dissecting forceps. The sample should be placed in sterile saline or other appropriate tissue culture media, sealed, and labeled. Ensure that the media container is completely filled as the sample may stick to the lid of the container in transport.



To Store: If necessary, the sample can be stored in the fridge at 4° centigrade. (The length of time the specimen can be stored should be determined locally in conjunction with the genetics laboratory). **Do not freeze.**

To Send: Transport to the cytogenetics laboratory promptly.

3. Handling Of Cytogenetic Specimens

- Send specimens to the lab as soon as possible.
- Complete cytogenetic requisition form.
- Label all vials (indicate "stillbirth").
- Pack specimen in specimen transport containers. If there is danger of extreme cold or heat during transport, ensure sample is properly insulated.

4. Cytogenetic Laboratories in British Columbia

Cytogenetic Laboratory
Room L225, Cellular Pathology
Children's and Women's Health Centre of British Columbia
4480 Oak Street
Vancouver, BC V6H 3V4
Tel: 604-875-2304
Fax: 604-875-3601

Cytogenetics Laboratory
Royal Columbian Hospital
330 East Columbia Street
New Westminster, BC V3L 3N7
Tel: 604-520-4484
Fax: 604-520-4409

Cytogenetics Laboratory
Victoria General Hospital
35 Helmcken Road
Victoria, BC V8Z 6R5
Tel: 250-727-4262
Fax: 250-727-4295

4. Pathological Examination of the Placenta

Examination of the placenta by the clinician at the time of delivery should include:

- Identification of number of vessels in umbilical cord
- Site of cord insertion into the placenta (central, marginal, into membranes)
- True knots
- Abnormal colour (meconium, suspected infection)
- Accessory lobes
- Focal lesions
- In multiple pregnancies, identification and labelling of cords

Some placental studies require sampling of the fresh, unfixed placenta. These include:

- Cases in where viral infection is suspected – subchorionic swab, villus tissue for viral PCR. If there is concern for viral infection, the specimen should be sent fresh
- Cases in which cytogenetic analysis is indicated – amnion and chorion submitted in cytogenetics medium, fresh chorionic villi frozen for comparative genomic hybridization (CGH) as backup for cytogenetic culture failure
- Cases of suspected genetic or metabolic condition – villus tissue fresh, frozen

If procedures are not in place to ensure that appropriate samples from the fresh placenta are procured prior to fixation, the placenta should be sent fresh and unfixed to the pathology department, with an appropriate requisition. The laboratory should be contacted to determine its specific specimen handling/transportation requirements.

Clinical units should consider implementing a process whereby placentas are kept refrigerated on the clinical unit for at least two (2) days after birth, in the event that clinical conditions that would warrant placental examination become evident in the neonatal period.

Clinical information regarding the pregnancy is mandatory and should be documented on the accompanying requisition. This information should include maternal age, gestational age, birth weight, sex, apgars, parity, prenatal investigations, and complications of pregnancy.

The following are indications for placentas to be sent to pathology for examination:

Fetal/Neonatal indications

- Prematurity (<34 weeks GA)
- Intrauterine growth restriction: BW<10th percentile for sex and GA
- Stillbirth/Neonatal death
- Fetal anomaly (including suspected chromosome abnormality); specify anomaly
- Hydrops fetalis
- Apgars<7 at 5 minutes
- Arterial pH<7
- Multiple gestation: birthweight discrepancy>20% or same sex with fused placenta
- Severe oligohydramnios
- Suspected infection – specify

4. Pathological Examination of the Placenta, *cont'd.*

Placental disc / cord indications

- Gross placental anomaly, such as accessory lobe, tumours, true cord knots, 2 vessel cord, velamentous insertion
- Retroplacental clot
- Chorioamnionitis
- Preterm premature rupture of the membranes

Maternal indication

- Severe diabetes
- Hypertension
- Coagulation abnormality e.g. ACA – specify

Indications for Cytogenetic Analysis of the Placenta

- Stillbirth, with or without fetal anomaly; amnion and chorion for cytogenetic culture, villus tissue for freezing for backup CGH as required

5. Maternal Mortality Review

[CONTENT TO COME]

6. Perinatal Mortality Review Committee: Terms of Reference

This document is designed to provide guidance and facilitate Perinatal Mortality review at the local and/or regional levels. It outlines the recommended terms of reference for hospital/regional perinatal mortality review committees. All perinatal mortality review committees are provided protection under s.51 of the B.C. Evidence Act. If a facility has a very small number of perinatal deaths, it is recommended that review be done at the regional or tertiary level. Including stillbirths and neonatal deaths, there will be approximately eight cases to review per 1,000 births. This can be achieved by referring to Investigation of Perinatal Deaths section.

Purpose

To monitor and improve obstetrical and neonatal care provided in British Columbia by:

A. **Reviewing** perinatal mortality cases (> 500 grams or 20 weeks gestation to 28 days of life inclusive).

B. **Classifying** all perinatal deaths using the PSBC Perinatal Death Classification System.

C. **Evaluating** the preventability of perinatal mortality cases.

D. **Recommending** methods to reduce the frequency of these events, including:
   - Recognition of Risk Factors for each classification of death.
   - Hospital policies and procedures review.
   - Education.

E. **Providing** perinatal mortality data to the B.C. Perinatal Database Registry for compilation of a regular B.C. Perinatal Mortality Report.

Multidisciplinary Membership

Could include

- Obstetrician
- Pediatrician
- Family Practitioner
- Pathologist
- Midwife
- Nurse
- Health Records Administrator
- Resident (Teaching hospitals)

Accountability

- Medical / Nursing/ Professional Advisory Committees
- Hospital Administration
- Health Authority

Frequency of Meetings

- Quarterly or at the call of the chair

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British Columbia Perinatal Mortality Form

Directions for use:
- This form is designed for use by Committees performing Perinatal Mortality Reviews.
- Definitions for Group Classification (Part I) and Preventability (Part IV) are on reverse of form.
- The form may be photocopied.
- One form should be completed for each perinatal mortality case.

Mother's Surname _____ Baby's Surname _____

Institution Name _____

Chart Number _____ ☐ Baby ☐ Mother PHN _____ ☐ Baby ☐ Mother

Date of Birth _____ Gestational Age _____ If Multiple, delivery sequence ____ of ____

☐ Male ☐ Female ☐ Ambiguous Autopsy: ☐ Full ☐ Partial ☐ No Autopsy

Part I. Group Classification
(see back of form)

Group 1	Group 2	Group 3	Group 4
☐ A	☐ A	☐ A	☐ A
☐ B	☐ B	☐ B	
	☐ C		

Evidence of Asphyxia: ☐ Yes ☐ No ☐ Unknown

Part II. Cause(s) of Death

Antecedent causes, if any, giving rise to the primary causes (a) above, stating **the underlying causes last.**

(a) _____
Primary Cause of Death *due to, or as a consequence of*

(b) _____
due to, or as a consequence of

(c) _____
due to, or as a consequence of

(d) _____
due to, or as a consequence of

Part III. Other Significant Conditions Contributing to the Death

☐ Maternal
☐ Placental / Cord _____
☐ Fetal _____
☐ Neonatal
☐ Socio-economic _____
☐ Unexplained
☐ Other _____

Part IV. Specify Preventability

1. ☐ Not Preventable 2. ☐ Possibly Preventable 3. ☐ Ideally Preventable

Comments _____

Name (print) _____ Signature _____ Date _____

Place of Review _____

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DEFINITIONS

Part I. Group Classification

Group 1: Lethal Congenital Anomaly (LCA)

A. Stillbirth ≥ 500 g. or ≥ 20 wks gestation

B. Neonatal Death

Note: terminations of pregnancy > 20 weeks GA are considered Group 1.

Group 2: Stillbirth ≥ 500 g. or ≥ 20 wks gestation

A. None – no signs of maceration, fresh stillbirth, implying intrapartum death.

B. Mild to Moderate – discolouration of umbilical cord, signs of skin slippage and bullae formation only. These cases have likely been dead in utero at least 6 hours, and in more extensive cases, over 24 hours.

C. Severe – bones are loosening and cranium collapsed. These cases have likely been retained in utero for days to weeks.

Group 3: Premature Deaths

A. $20-33^{6/7}$ weeks (early preterm)

B. $34-36^{6/7}$ weeks (late preterm)

Group 4: Term Deaths

A. $37-41^{6/7}$

Part IV. Specify Preventability

1. Not Preventable

All the following criteria have to apply for a death to be classified as non-preventable.

- Prenatal care and fetal surveillance were adequate and appropriate
- Intervention was available, accessible, appropriate and timely
- Circumstances surrounding a death were not preventable
- All standards of care were met

2. Possibly Preventable

- Unrecognized, but detectable fetal or newborn compromise which was not detected or not appreciated
- Inappropriate, inadequate or untimely intervention
- One or more standards of care may not have been met

3. Ideally Preventable

- A sudden, compromising event for the fetus or newborn where intervention was not possible on this occasion
- Geographic isolation where resources necessary for management were not available
- Patient choice to decline necessary treatment or intervention
- All standards of care were met

Appendix B: Diagnosis of Fetal Asphyxia (Hypoxic Acidaemia)

Society of Obstetricians and Gynaecologists of Canada
Clinical Practice Guideline
Fetal Health Surveillance: Antepartum and Intrapartum Consensus Guideline
September 2007 page S25

	Severity of the Hypoxic Acidaemia	
	Umbilical Artery pH	Umbilical Artery Base Deficit
Intervention Acidaemia	< 7.15	> 12 mmol/L
Possible Brain Damage Acidaemia	< 7.0	> 12 mmol/L

The essential characteristics of the newborn response to asphyxia of such a degree as to be likely to cause harm are:

- Apgar score 0 to 3 for ≥ 5 minutes
- Neonatal neurologic sequelae (e.g. hypotonia, seizures, coma)
- Evidence of multi-organ system dysfunction in the immediate neonatal period
- Umbilical cord arterial pH < 7.0, and
- Umbilical cord arterial base deficit > 12 mmol/L
- Early onset of severe or moderate neonatal encephalopathy in newborns born at or beyond 34 weeks gestation
- Cerebral palsy of the spastic quadriplegic or dyskinetic type*
- Exclusion of other identifiable etiologies such as trauma, coagulopathy, infectious conditions or genetic disorders

All of these conditions must be present. In cases where evidence is lacking, we cannot conclude that hypoxic acidaemia existed or had the potential to cause neurologic deficits.

The presence of hypoxic acidaemia confirms that an episode of intrapartum fetal asphyxia has occurred. If the neonatal signs are lacking, then the duration of the asphyxial episode has been short and the likelihood of brain damage and neurologic deficits is small. However, in those cases with hypoxic acidaemia at the time of delivery and with neonatal complications, the potential for brain damage and resultant neurologic deficits is present.

NOTE:
In cases where an autopsy is conducted and it is the opinion of the fetal/pediatric pathologist that histologic changes consistent with an asphyxia event are present, intrauterine asphyxia is determined to have occurred. Agonal changes such as fetal squamous cells in the lungs are not generally considered sufficient to make a diagnosis of asphyxia.

* Spastic quadriplegia and less commonly, dyskinetic cerebral palsy, are the only types of cerebral palsy associated with acute hypoxic intrapartum events. Spastic quadriplegia is not specific to intrapartum hypoxia. Hemiparetic cerebral palsy, spastic cerebral diplegia and ataxia are unlikely and to result from acute intrapartum hypoxia.

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Perinatal Services BC
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