WASHINGTON STATE DEPARTMENT OF HEALTH

Guidelines for Performance of an Autopsy

in the Setting of a Potential Maternal Death in the State of Washington

AUGUST 2018

In accordance with RCW 70.54.450

Background

In 2016, the legislature passed RCW 70.54.450 which called for the creation of the Maternal Mortality Review Panel (MMRP) to conduct "comprehensive, multidisciplinary reviews of maternal deaths in Washington to identify factors associated with those deaths and make recommendations for system changes to improve health care services for women in this state."

The first review of maternal mortality focused on the 2-year period from 2014–2015. The Washington Department of Health (DOH) Maternal Mortality Review Panel (MMRP) found that not all pregnancy-related deaths were reported to the local coroner or medical examiner office. In addition, autopsies were not always performed for pregnancy-related deaths, and the quality of autopsies was variable and sometimes suboptimal (DOH, 2017). Autopsy is considered an important component in the accurate determination of cause of death. Many deaths during pregnancy, labor, delivery, and post-partum are considered to be unexpected (and often sudden) deaths, even when they are of natural manner, and it is important to determine the cause(s) and contributory factors for those deaths. Because maternal deaths are relatively unusual, and may be associated with clinical and pathologic features not commonly evaluated by many autopsy pathologists, the development of guidelines and an associated checklist was considered to be likely to improve the quality of death evaluation and in that way, improve to improve maternal health in the state of Washington. Guidelines and an associated checklist are provided below.

DEFINITIONS

Maternal death: According in to RCW 70.54.450 a maternal death is a death that occurs during pregnancy or within the first year after the end of pregnancy from any cause. For the purposes of reporting and autopsy of maternal deaths as outlined in this document, only maternal deaths that occur during pregnancy or within 42 days after the end of pregnancy should be considered.

Mission Statement

The Autopsy Guidelines for Maternal Deaths are designed to be used by the pathologist performing the autopsy. The autopsy may be performed under the jurisdiction of either a coroner or medical examiner. In non-jurisdictional cases, the autopsy may be performed by a hospital pathologist authorized by the next-of-kin. The associated checklist should be completed and included as part of the autopsy report.

The purpose of these guidelines is to assist the pathologist in focusing on particular issues of deaths related to pregnancy, in order to optimize the autopsy procedure and report for clear identification of the cause of death and any contributory factors. It is important that a complete autopsy be performed in most cases. This information will be used toward improving obstetric practice and preventing maternal mortality, not to address issues of possible negligence or accountability.

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Procedures for Maternal Deaths

I. Initial Investigation

- Scene investigation for out-of-hospital death.
  - Standard guidelines apply (photographs, documentation of medications per office guidelines, etc.).
  - For un-natural deaths, use usual standard investigational protocols.
- Circumstantial information specific to pregnancy related/associated deaths.
- General circumstances of death (in or out of hospital).
- Is death during pregnancy, during labor, during delivery, post-partum, or after a miscarriage or pregnancy termination (abortion)?
- At what gestational age was the delivery/pregnancy end, or how many days post-partum did the death occur?
- Any complications? (preterm rupture of membranes, prenatal ultrasound abnormalities, no prenatal care, etc.)
- What was the gestational age (weeks and days) at the time of labor onset, delivery, etc.?
- What happened to the infant/fetus? (liveborn, term or preterm, fetal demise, NICU)
- For an infant, were there any problems? (small, large, distressed at birth, sepsis)
- Where did delivery occur (if applicable)? (hospital, home, birthing center, abortion clinic, other)
- Type of delivery? (vaginal, cesarean, vacuum, forceps, any known problem)
- Type of anesthesia? (none, epidural, general, etc)
- Apgars of infant? (resuscitation, etc.)
- When did hospital/birth center discharge occur for mother and for baby?
- Any maternal medical evaluation since then?
- Names/contact information of obstetric providers (pregnancy, delivery, post-partum) and anesthesia providers (if indicated).
- If hospital or birth center death, contact information for provider(s) during care and delivery.
- If post-partum, status of infant and name and contact information for infant provider(s).
- General pre-pregnancy health status, including past pregnancy history.
  - In particular, hypertension, diabetes, heart disease, sickle cell disease or trait, lung disease, epilepsy, thrombophilia, malignancy, HIV/AIDS, cystic fibrosis, connective tissue disorders (including Ehlers Danlos, Marfan, etc), autoimmune disease. *May also want family history of pregnancy associated deaths* (*raising concern for genetic disease).*
- Medical history of current pregnancy.
- List all medications during or after pregnancy.
- Standard social and drug/alcohol/tobacco history.

II. Medical Records

- Obtain copies of all obstetric related medical records from the delivery facility (labor, delivery), sites of hospitalization prior to or after delivery, and from the obstetric provider, along with contact information for all primary OB and hospital providers.
- Include antemortem lab data (especially cultures, coagulation and hematology).
- **Contact information is critical. Ideally, the autopsy pathologist should consider discussion of the case prior to autopsy with the primary obstetrician and/or delivering provider and/or involved clinician at the time of death.**

III. Antemortem Pathology Specimens/Fetal or Infant Demise

- If hysterectomy was performed, request that the surgical specimen be retained after examination, and transferred to the examining autopsy pathologist. In all cases (whether discarded or transferred to autopsy pathologist for examination), request slides, copies of reports, and photos of gross specimen if available.
  - In general, it is best that any hysterectomy or other surgical specimen be examined by the usual surgical pathology system, prior to transfer to the autopsy pathologist for review/possible retention.
- If placenta was delivered, it should be examined via the usual surgical pathology system used by the delivering institution. Following examination, the fixed placenta specimen should be retained and provided to the examining autopsy pathologist for review as indicated. Request copies of reports.
- If there is no system in place for placental examination, the placenta should be retained by the institution and obtained for the pathologist to examine as examined as part of the autopsy. It can be retained fresh and refrigerated for up to 48 hours, but should ideally then be fixed in 10% buffered formalin in a flat configuration.
- If there has been a fetal or infant demise, consider autopsy of the fetus or infant, with that determination based on the unique circumstances of each case. If a decision is made to NOT perform an internal dissection of the fetus or infant, routine external examination with photographs and standard measurements (weight, crown rump and crown heel, head circumference, foot length) should be performed, noting any developmental anomalies.

IV. Required Facility and Resources*

- Autopsies in the setting of possible pregnancy related deaths require good mortuary and laboratory facilities with resources for photography, histology, and tissue retention. Performance of these autopsies in funeral homes is not considered appropriate/ideal.
  - Ideally, the facility should have sterile microbiology specimen containers and blood culture bottles with available associated laboratory facilities. In addition, facilities for storage of frozen specimens and formalin fixation of specimens (placenta, uterus) should be available.
- Photographs of any external abnormalities, major internal findings, and the pelvic organs are required.
- Routine histologic evaluation will be more extensive than the usual trauma-related autopsies. Small tissue samples from most organs and tissues will be fixed in formalin for possible further evaluation ("histology stock"). Include a sample of rib or vertebral bone marrow in stock in all cases.
- It is preferable that these autopsies be performed in facilities and by pathologists with more expertise/experience with maternal autopsies, as many pathologists have no experience with the maternal death autopsy. Pathologists/coroners should consider referral of these cases.
- Examinations of the placenta and/or gravid uterus are important components of the maternal autopsy as is the interpretation of the clinical course. Performing pathologists should avail themselves of the clinical and subspecialty pathology consultation which will be available via the DOH MMRP coordinator (see below). In certain settings, evaluation of the heart (after fixation) by a cardiac pathologist or brain by a neuropathologist may be indicated, as determined by the autopsy pathologist and the initial autopsy results.

** more details in autopsy guidelines*

- Toxicology samples should be retained and samples submitted per standard protocol.
- In the setting of possible sepsis/infection, samples from the area of suspected or identified infection (uterus, skeletal muscle, etc.) should be histologically evaluated, frozen for possible more specific molecular microbiologic diagnosis (per autopsy results), and cultured, if possible. If culture is not feasible, freeze areas of suspected infection.
  - For suspected sepsis, if an antemortem blood culture was not obtained, a sample of postmortem blood (always using a vessel above the diaphragm), spleen tissue or swab of visceral pericardium can be obtained using sterile technique, and either cultured and/or frozen for possible later diagnostic testing for micro-organisms.
- A blood sample in an EDTA (purple top) tube and/or frozen tissue (liver or skeletal muscle) should be retained for possible genetic testing.

Abbreviated Guidelines for Autopsy of a Maternal Death

I. External Examination

- Document condition of body including evidence of injury and evidence of medical therapy, including incisions (examine surgical incisions for evidence of infection, depending on time since surgery). Include standard external photographs and specific photographs documenting injury or natural disease.
- Collect evidence if applicable.
- Body length and weight should be obtained in all cases.
- Examine external genitalia/perineal region. Document any lacerations or other injuries, including photographic documentation.

II. Internal Examination

- Pathologist must be present when body is opened and during evisceration. Examination of pelvic organs should occur in-situ prior to removal. In-situ photographic documentation of any abnormalities.
- If air embolism is a consideration, open skull prior to thoraco-abdominal incisions. Observe cerebral vessels in-situ for presence of air. Open heart under water placed in the pericardial sac, to exclude air in the RV.
- Document quantity of blood or fluids present in body cavities. Determine source of blood (ruptured ectopic, ruptured uterus, aneurysm, etc.)
- Routine samples obtained and retained for possible toxicology (including blood, urine, vitreous humor).
- All major pathologic findings should be photographically documented.
- For thromboembolism, identify source, if possible, considering pelvic/periuterine veins in the pregnancy or early post-partum setting.
- Detailed examination of heart should include a trimmed weight.
- For deaths during pregnancy, labor, delivery, and immediate post-partum period, uterus, fallopian tubes, and ovaries should be removed (including cervix, if possible). Describe and document external appearance of uterus, including whether it is intact, evidence of cesarean delivery, etc. See below.
- If placenta is still in the uterus, do not remove prior to opening the uterus. If previously delivered, obtain placenta after examination (fixed) or prior to examination (if no routine pathology examination available). Unfixed placenta should be fixed flat and intact with umbilical cord attached. See below for placental examination.

- Central Nervous System:
  - Consider fixation of the brain and referral for neuropathologic (NP) examination King County Medical Examiner (KCME), depending on the findings and clinical setting.
  - In all cases, consider external photograph of brain to allow consultation about cerebral edema. May also wish to photograph base of brain to document presence or absence of herniation.
  - For subarachnoid hemorrhage, evaluate dural venous sinuses for thrombosis and cerebral arteries for aneurysm. Consider NP referral.
  - For known seizure disorder and concern for sudden unexpected death in epilepsy (SUDEP), and possible eclampsia, follow SUDEP protocol and consider NP referral.

III. Histology

- Routine samples should be evaluated in every case including heart, coronary artery, lung (one sample from each of five lobes), kidney, liver, spleen, whole pituitary, adrenals, brain with leptomeninges, full thickness uterus. Multiple samples of lung are important for assessment of amniotic fluid embolism.
- Additional samples of pathologic findings.
- Specific Concerns:
  - Areas of possible infection, with adjacent tissue frozen for possible molecular organism ID. Histologic sampling of endomyometrium/soft tissue in necrotizing soft tissue infection can be diagnostic.
  - Parametrial vessels and additional lung for possible amniotic fluid embolism. In cervical/vaginal/uterine injury (usually iatrogenic), sample areas of injury after photography (disrupted vessels may be identified).
  - Uterus, ovaries, and ectopic pregnancy in ruptured ectopic pregnancy.
  - Pulmonary thromboembolism: Sample known or likely deep venous thrombosis, and the thrombus, including any areas of adherence. Sample any older thromboemboli.
  - See below regarding placenta and uterus histology.

IV. Toxicology and Vitreous Humor/Microbiologic Testing

- Routine toxicology sampling and testing for acute intoxication. Provide laboratory with information about any prescribed medications (particularly anti-epileptic drugs). Retain toxicology samples per routine.
- Vitreous electrolyte testing for concern about diabetes/electrolyte abnormalities.
- Microbiologic testing (clear evidence of infection): Consider culture of infectious area, per usual routine. If there is concern about puerperal or postpartum sepsis, consider culture and/or frozen tissue of area of concern for molecular microbiologic testing. For example, freeze a small piece of uterus including endometrium, spleen (instead of blood), muscle (necrotizing fasciitis). Concerns include Group *A Streptococcal* sepsis, *E. coli*, *Clostridium* (post-partum uterine sepsis).
- Deep freeze one sample of tissue (small piece of skeletal muscle, liver) for possible genetic testing at –20° C (particularly with cases of fatty liver, cardiomyopathy, or vascular dissection).

V. Clinical and Pathologic Consultation Available at No Charge (Access via the DOH MMRP Coordinator)

- Assistance with review and interpretation of clinical records will be available at no charge to the autopsy pathologist, via a DOH MMRP consultation group of maternal-fetal medicine and obstetric providers. This consultation is provided because of the importance of clinical and pathological correlation in the assessment of maternal mortality. Most pathologists may not be familiar with current obstetric diagnostic and therapeutic guidelines and will find the clinical expertise valuable.
- Placental and obstetric (including gravid uterus) pathology comprise a sub-specialty of anatomic pathology in which the autopsy pathologist may have little experience and/or expertise. The DOH MMRP includes pathologists with expertise in obstetric and placental pathology who are willing to review pathology findings and/or histology at no charge, as the evaluation of these tissues may be helpful in the evaluation of a maternal death.
- Other consultation assistance with recommendations for specific laboratory testing (for example, molecular microbiologic testing, genetic testing) may be pursued by first contacting the DOH MMRP Coordinator, who may direct the autopsy pathologist to other consultants for assistance.

VI. Handling the Placenta

- The management of the placenta will depend on the individual circumstances of the death.
- In hospital death (post-partum), the placenta should be examined, ideally using the hospital system of surgical pathology examination of the placenta. Examined specimen should be retained and sent to the autopsy pathologist for review.

  If there is no system in place for placental examination (for example, if the death occurs at a birthing center in which placental examination is not usually done, have the placenta placed fresh in a labelled plastic bag or container, and refrigerated. The placenta should ideally be fixed in formalin within 48 hours. The examination can be done as part of the autopsy, or examination can be arranged with an associated pathology system (details to be worked out). If the autopsy pathologist is to examine the placenta, have the placenta fixed flat completely covered with 10% buffered formalin with the umbilical cord attached, in a covered container, until examination occurs.
- Standard placental histologic evaluation includes sections of the umbilical cord at the placental disc attachment, a free membrane roll, a trimmed weight (specify as to fixed or unfixed), and two-four representative full-thickness central sections of the serially sectioned disc, with any abnormalities described and histologically sampled.

VII. Examination of the Gravid Uterus

- In-situ examination of uterus, fallopian tubes, and ovaries (anterior and posterior). Make note of any lacerations or surgical incisions or areas of bulging, thinning, or external extension of the placenta (through the uterine serosa). Photographic documentation.
- Pelvic organs should be removed en bloc without opening the uterus, and ideally with the attached intact cervix.
- Examine the cervix and document the appearance photographically.
- How the uterus is opened will depend on the case: If the infant/fetus was delivered (as in the setting of a hospital death), versus IUFD (undelivered) versus placenta (delivered or not). In most cases, the infant or fetus will have been removed. However, if there is a fetus present, when the uterus is opened, photograph the fetus, document position, and remove. An external examination of the fetus should always be performed (emphasizing

size, sex, and external developmental anomalies). Internal examination is generally recommended, but individual circumstances can be considered.

- The uterus should be examined externally. In most cases, the placenta will be either anterior or posterior, and the uterus will be optimally opened through the cervix ("bi-valved") to anterior and posterior halves. This can be varied depending on clinical or pathologic findings. Note the position of the placenta, or, if it was delivered, note the presence of any retained pieces of placenta. If the placenta is present, note the estimated size, and how close it is to the cervical os. Measure the umbilical cord. If possible, fix the bi-valved uterus (with attached placenta). The uterus with placenta should be serially sectioned, measuring the placental thickness and uterine thickness, and noting any areas of previa, placenta accreta (increta or percreta), retroplacental hemorrhage (signifying placental abruption), or evidence of infection. Photograph external, opened, sections, and abnormalities.

  Histologic sections should include at least one full-thickness section of the uterus (based on the findings, include one with central placental disc and one without placenta), a representative section of parametrial vessels, and sections demonstrating any abnormalities (abnormal placental attachment, retained placenta, etc.).

VIII. References

- Washington State Legislature. (2016). Revised Code of Washington: 70.54.450. Maternal mortality review panel. Retrieved from: http://app.leg.wa.gov/RCW/default.aspx?cite=70.54.450
- Washington State Department of Health (WA DOH). (2017). 2014–2015 Maternal Mortality Review. Retrieved from: https://www.doh.wa.gov/Portals/1/Documents/Pubs/140-154-MMRReport.pdf
- The Royal College of Pathologists: Guidelines on Autopsy Practice. Scenario 5: Maternal death, May 2010. Professor Sebastian Lucas, Coordinator. Guidelines currently under revision. www.rcpath.org
- Khong TY et al. Sampling and Definitions of Placental Lesions; Amsterdam Placental Workshop Group Consensus Statement. Arch Pathol Lab Med. 2016; 140: 698–713.

Washington State Department of Health

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Maternal Autopsy Checklist

Case/Decedent Information

Name _____ **Age** _____ **DOB** _____ **DOD** _____

Autopsy Date _____ **County** _____ **Pathologist** _____

Was this person known to be pregnant at the time of death? ❑ Yes ❑ No

Pregnant in the last 3 months? ❑ Yes ❑ No If Yes, when? _____

Miscarriage? ❑ Yes ❑ No If Yes, at what gestational age? _____

Term or preterm (<37 weeks) live birth? ❑ Yes ❑ No

If Yes, at what gestational age? _____ Infant status? _____

Pregnancy termination? ❑ Yes ❑ No

Care Provider and Facility

Name _____

Location _____

Contact Information _____

Clinical Summary: Scene and Circumstances

Circumstances of death with respect to pregnancy: _____

_____

Known pregnancy history/complications: _____

_____

Other medical history: _____

Known prescription or over-the-counter medication use: _____

_____

Ethanol/substance use: _____

Smoking status: _____

Contact physicians or care providers? ❑ Yes ❑ No

Name and contact info for person contacted: _____

Request/review medical records? ❑ Yes ❑ No

Photographs

❑ Standard External Overall Photographs ❑ Major Internal Findings

❑ External Abnormalities ❑ Pelvic Organs

External: Specific to Maternal Mortality (Evidence collection, per routine, if indicated)

Body length: _____ Body weight: _____ ❑ True ❑ Estimated

External genitalia abnormalities? ❑ Yes ❑ No If Yes, what? _____

_____

Internal: Specific to Maternal Mortality

Procedures for air embolism? ❑ Yes ❑ No

Death during pregnancy, labor, delivery, or immediately post-partum? ❑ Yes ❑ No

Fetus/infant present? ❑ Yes ❑ No

If Yes, standard measurements and external exam? _____

Uterus retained and fixed? ❑ Yes ❑ No

Separately received placenta? ❑ Yes ❑ No

Placenta examined at hospital? ❑ Yes ❑ No

If Yes, report requested ❑ Yes ❑ No

If Yes, placenta requested ❑ Yes ❑ No

Histology

Routine, per protocol ❑ Yes ❑ No

Additional (list): _____

Toxicology

Routine sampling for acute intoxication, per protocol ❑ Yes ❑ No

Microbiology

Culture ❑ Yes ❑ No If Yes, site: _____

Histology and adjacent frozen? ❑ Yes ❑ No If Yes, site: _____

Neuropathology

Examined fresh? ❑ Yes ❑ No

Fixed? ❑ Yes ❑ No

NP consultation? ❑ Yes ❑ No

SUDEP protocol? ❑ Yes ❑ No

Cardiovascular Pathology

Trimmed heart weight: _____ grams

Retained fixed heart for consultation? ❑ Yes ❑ No

Retained Blood/Tissue

Histology Stock (samples from all organs/tissues, including rib or vertebral bone marrow):

❑ Yes ❑ No

Toxicology sample routine retention? ❑ Yes ❑ No

Vitreous humor tested? ❑ Yes ❑ No Retained? ❑ Yes ❑ No

Frozen tissue (–20° C) for possible genetic testing/DNA banking, particularly for cardiomyopathy, fatty liver, vascular dissection (concern for Ehlers-Danlos/Marfan syndrome)

❑ Yes ❑ No If Yes, tissue type: _____

Consultative Services

Contact DOH Maternal Mortality Coordinator:
maternalmortalityreview@doh.wa.gov 360-236-3510

Clinical Record Review/Interpretation ❑ Yes ❑ No

Placental and obstetric pathology review (gross/histology) ❑ Yes ❑ No

Other (molecular microbiology/cardiovascular/etc) ❑ Yes ❑ No

If Yes, what? _____