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SPECIAL ARTICLE

Practical Initial Evaluation of Fetus and Placenta of Stillbirths for Obstetricians in Delivery Room

Patou Tantbirojn, M.D.*

** Placental Research Unit and Division of Gynecologic Pathology, Department of Obstetrics and Gynecology, Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand*

ABSTRACT

Gross examination of fetus and placenta can simply be performed immediately after delivery in delivery room by the delivery attendant. The practical points and necessary assessment of fetal anomalies and placental examination have been summarized. The examination is not complicated and should be done in every stillbirth.

Keywords: stillbirths, gross examination, placenta.

Correspondence to: *Patou Tantbirojn, M.D., Placental Research Unit and Division of Gynecologic Pathology, Department of Obstetrics and Gynecology, Faculty of Medicine, Chulalongkorn University, Bangkok 10330, Thailand. Email: two_devil @hotmail.com*

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Stillbirth as defined by World Health Organization (WHO) is a baby born with no signs of life at 22 or more completed weeks of gestation or the birth of a stillborn that weighs at least 500 grams[1]. The "no signs of life" is indicated by the absence of breathing, heartbeats, pulsation of the umbilical cord, or definite movements of voluntary muscles. However, due to differences in capacity in measurement and ability of perinatal care, the definition is varied among institutes. For international comparisons, the definition is extended to include fetuses that are, by order of priority, of at least 1000 g birthweight, and/or at least 28 weeks gestation, and at least 35 cm long[2, 3].

Stillbirths can be divided into two categories based on the correlation of fetal death detection and the onset of labor as 1) antepartum stillbirths and 2) intrapartum stillbirths. Intrapartum stillbirths reflect the quality of care during labor, while antepartum stillbirths may represent the quality of antenatal care services and fetal surveillance. Determining a cause of stillbirth is very important as it may reveal an underlying maternal medical condition or pregnancy associated morbidity which affects further treatment and management of subsequent pregnancies. In general, the main components of evaluation of stillbirth are clinical history, perinatal autopsy, placental examination, and genetic testing. Further laboratory tests are rather time-sensitive and should be considered individually based on the

results of initial testing and relevant clinical setting[4]. Unfortunately, the autopsy rates are decreasing nowadays. This is owing to lack of parental consent, lack of skilled perinatal pathologists, cost containment, and technical limitations of conventional autopsy[5, 6]. Many families are reluctant to proceed with an evaluation for stillbirth, especially fetal autopsy and genetic testing. Besides of the increasing expenses, their perception is the workup will not bring their baby back and not guarantee of any direct benefits. Some misconceptions concern that the autopsy will disfigure the body which is prohibited and will affect with burial ceremony or rebirth in the next life by religious beliefs. The sending of placenta for pathologic examination is also refused by some personal beliefs. Although there are modern imaging techniques such as microfocus computed tomography (CT) and 3 Tesla magnetic resonance imaging (MRI) to perform virtual autopsy, but it is still limited by the resources and expenses[7]. The lack of histology is also a limitation of all postmortem imaging techniques, but it can be partially compensated by adding image-guided needle tissue biopsy.

In case that the complete fetal autopsy or placental pathologic examination is declined, and imaging is unavailable, the alternative method is only external fetal examination in which the attending obstetrician has to be the one who perform in delivery room. Many obstetricians lack the confidence to do and worry to misinterpret the findings. In fact, the examination is not complicated and should be done in every stillbirth, even in case that will be submitted for autopsy.

Examination of the baby[8, 9]

The birth attendant should perform a complete examination of the baby shortly after birth before being sent to autopsy by pathologist. If possible, a chart should be available to guide the examiner to record all the required examined parts as follows:

1. Weighing the baby in grams
2. Measurements

Measurements consist of head circumference (HC), chest circumference (CC), abdominal circumference (AC), crown-rump (CR) length, crown heel (CH) length, foot length (FL), inner and outer canthal distance, interpupillary distance, and measurements of the cranial fontanels. However, if there are not available tools, the minimal measurement should be length and foot length. The CR length is usually two-thirds of the CH length. The CH length and HC usually not differ more than 1 cm and can be roughly used as indicator of macrocephaly or microcephaly. Fetal foot length is a reliable parameter for use in the assessment of gestational age and is particularly useful when other parameters do not accurately predict gestational age, for example, severely macerated fetuses, fragmented fetuses, and in fetuses with major malformations such as hydrocephalus, anencephaly, and short limb dysplasia[10, 11].

3. Evaluate degree of maceration to determine the estimated time of fetal death[12, 13]

Degree of desquamation and cranial compression are capable in predicting the time interval from fetal death to delivery. However, the maceration rate may be influenced by maternal fever, fetal or placental infection, fetal hydration at the time of death, amniotic fluid volume, and delay from delivery to postmortem examination. The extent of maceration and estimated time of death is showed in Table 1.

Table 1. Time table of macroscopic features caused by maceration after intrauterine fetal death[13].

Intrauterine duration of retention	Gross examination
6 hours	Desquamation of patches 1 cm; brown or red discoloration of umbilical stump
12 hours	Desquamation on face, back, or abdomen
18 hours	Desquamation of 5% body, or 2 or more body regions
24 hours	Brown or tan skin discoloration on abdomen Moderate desquamation
36 hours	Cranial compression
48 hours	Desquamation of > 50% of body
72 hours	Desquamation of > 75% of body
96 hours	Overlapping cranial sutures
1 week	Widely open mouth
	Collapse of calvarium
	Laxity and dislocation of joints
2 weeks	Mummification (dehydration, compression, tan color)

4. Systematic external examination includes

4.1. Head:

4.1.1. Shape, fontanelles, sutures, and skull bone abnormalities.

The skull deformation is proportional to the extent of the sutures involved. Early fusion of one or more cranial sutures (craniosynostosis) results in a characteristic dysmorphic head shape (Table 2). Nonsyndromic craniosynostosis can be classified into isolated and complex fusions. Isolated fusions involve only single cranial suture and are more common than complex craniosynostosis.

4.1.2. Size.

Microcephaly is a small head and defined as head circumference smaller than 3 standard deviations (SD) below the mean for the gestational age[15]. In contrast, macrocephaly or large head is defined as occipitofrontal head circumference above the 98th percentile or greater than 2 SDs above the mean for gestational age[16].

Table 2. Example of head deformities in craniosynostosis[14].

Fused suture	Gross examination
Isolated craniosynostosis	
Sagittal	Scaphocephaly (meaning boat-like) or dolichocephaly (meaning long)
	- Long, narrow head
	- Decreased posterior skull width and height
	- Frontal bossing
	- Bitemporal narrowing
Metopic	Trigonocephaly (triangular-shaped head)
	- Triangular-shaped forehead
	- Bitemporal narrowing
	- Supraorbital retrusion and deficient lateral orbital rims with hypotelorism
	- Occipitoparietal widening
Coronal	Unilateral coronal synostosis creates an anterior plagiocephaly (asymmetric anterior head shape)
	- Asymmetric anterior head shape
	- Ipsilateral forehead flattening
	- Ipsilateral supraorbital rim elevation and retrusion
	- Contralateral frontal bossing
	- Deviation of nasal root towards affected side
Lambdoid	Unilateral lambdoid synostosis creates posterior plagiocephaly (asymmetric posterior head shape)
	- Asymmetric posterior head shape
	- Ipsilateral occipital flattening
	- Ipsilateral occipitomastoid bulge
	- Reduction of ipsilateral skull height
	- Inferior positioning of ipsilateral skull base
	- Contralateral frontoparietal bossing
Complex craniosynostosis	
Bicoronal	Brachycephaly (short head shape)
	- Short head in anteroposterior dimension and wide transverse diameter
	- Tall forehead (turricephaly)
	- Forehead flattening with elevated both eyebrows
	- Large or bulging eyes
	Some individuals develop acrocephaly (conical-shaped head) if the anterior fontanel is open
Bilateral lambdoid	Deformational plagiocephaly
	- Flattened occipital region
	- Widened occipitoparietal region
	- Elongation of the vertex
Sagittal and both lambdoid sutures	Mercedes Benz pattern craniosynostosis
	- Anterior turricephaly
	- Brachycephaly
	- Decreased posterior skull width
	- Flattened occiput with sublambdoidal indentation

5. Facial features: ears, eyes, nose, mouth[17]

5.1. Ears: shape, position, and patency of ear canal.

Low-ser ears are present when the helix (curved upper part of the outer ear) meets the cranium at a level below the horizontal plane with the corner of orbit. Slanted ears occur when the angle of the slope of the auricle exceeds 15 degrees from the perpendicular[18]. (Fig. 1)

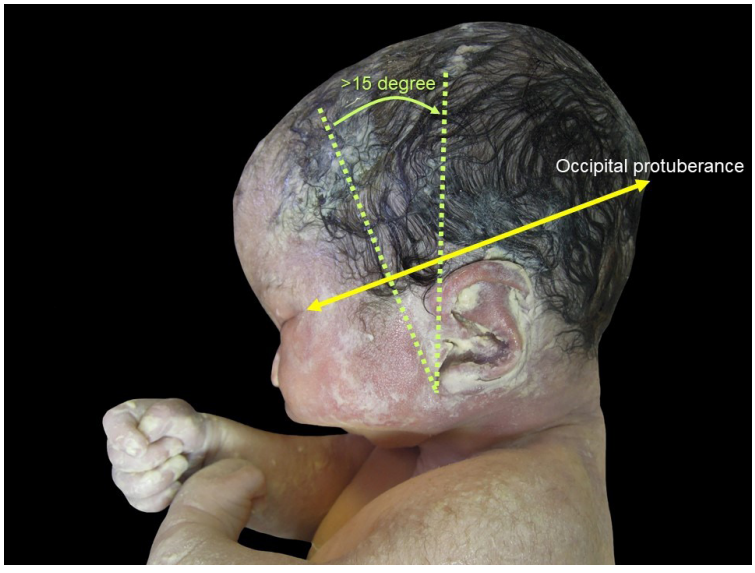

Fig. 1. Low-set ears

5.2. Eyes: eyebrows, eyelashes, fusion of eyelids, abnormal folds (such as epicanthal folds), slanting of palpebral fissures, pupils (shape and size), iris (color and colobomas), sclera (color), conjunctiva, and corneal opacification.

The interocular distance and the binocular diameter are helpful in determining hypo- or hypertelorism. Hypertelorism is defined as an interocular distance of > 95th percentile for gestational age, while hypotelorism is defined as an interocular distance of < 5th percentile for gestational age[19, 20].

5.3. Nose: shape, nasal bridge flatness or prominence, nares, and patency of choanae

5.4. Mouth: philtrum, lips, hard and soft palate, including the uvula, tongue, frenula, and teeth.

It is important to always examine the palate because cleft palate can occur as an isolated defect. In case of facial clefts, the examiner should state the location of cleft (lip, alveolus, hard palate, or soft palate; including lateral (unilateral or bilateral) or median) and severity of the defect. The degree of clefting can vary from a notch to a full-thickness cleft[21].

5.5. Chin: shape and size.

The chin and mandible are normally easily assessed subjectively and should be aligned with the upper lip and nose in the midsagittal view of the fetal face. The fetus with micrognathia or retrognathia will appear to have an overbite caused by the small and/or posteriorly displaced mandible[22].

6. Neck: length of neck, mass, cystic hygroma, neck web, and abnormalities of nuchal skin.

7. Chest: shape, size, and symmetry.

Abnormal appearance of the chest can vary from mild to severe. Examples of chest wall deformities are shown in Table 3.

Table 3. Example of chest wall deformities[23, 24].

Anomalies	Gross examination
Pectus Excavatum (sunken chest)	Central depression of the sternum, typically the lower half of the sternum, producing a funnel-shaped chest
Pectus Carinatum (pigeon chest)	Outward protrusion of the sternum and ribs
Pectus arcuatum (costomanubrial pectus carinatum (type 2), pouter pigeon breast, arcuate pigeon breast, Currarino-Silverman syndrome)	"Carinatum superiorly and excavatum inferiorly" - Anterior angulation of the superior ribs and cartilages (especially 1–3) - Foreshortened unusual sternum with anterior angulation of the manubrium - 90° angulation with posterior indentation
Jeune Syndrome	Small bell-shaped chest - Extremely small chest - Broad and short ribs with irregularly joined to the costal cartilages and sternum
Poland Syndrome	Spectrum of abnormalities of one side of the chest - Absence of the pectoralis muscle(s) - Under development of breast tissue and areola - Deformity of the costal cartilages of the upper ribs - Inadequate development of the arm, hand, and fingers of the same side
Sternal defects	Sternal defects are classified into three groups: 1) Sternal cleft - Failure of fusion of the two sternal halves, most commonly located superiorly - Heart position is usually normal - Intact skin integrity 2) Ectopia cordis - Abnormal position of the heart partially or totally outside the chest - 4 types based on the location of heart: cervical, thoracic, abdominal, and thoracoabdominal 3) Cantrell's pentalogy (thoracoabdominal type of ectopia cordis) consists of 1) omphalocele, 2) anterior diaphragmatic hernia, 3) ectopia cordis, 4) cardiac anomalies, and 5) sternal cleft

8. Nipples: position and presence of palpable breast tissue and internipple distance

9. Abdomen: distension, defects, umbilicus, and umbilical stump.

The two most common congenital abdominal wall defects are gastroschisis and omphalocele. The main distinguishing features are that gastroschisis has no sac and the defect is located to the right of the midline and the umbilical cord, whereas an omphalocele typically has a sac and the defect is at the base of umbilicus[25]. Size of the defect and protruding visceral organs should be recorded.

10. Genitalia:

10.1. Female: labia and clitoris (appearance and size), vagina (patency, hymenal ring, and duplication)

10.2. Male: penis (appearance, size, and position of meatus) and scrotum (appearance and position of testes)

11. Anus: position and patency

12. Back/vertebral column: alignment, neural tube defects, sacral dimples, and pigmented spots. There are many different types of neural tube defects with varied deformities as shown in Table 4.

Table 4. Spectrum of neural tube defect[26].

Anomalies	Gross examination
Anencephaly	Absence of most of the brain and most or all of the cranial vault
	- Meroacrania: the defect is localized to the cranium
	- Holoacrania: the defect ends through the foramen magnum
Exencephaly	Absence of the cranial vault, but with intact exposed brain tissue
Iniencephaly	Fixed fetal head retroflexion
	- Head is extremely retroflexed and absent neck
	- The face skin is continuous with the chest skin
	- The posterior scalp is directly connected to the skin of the back
	- Occipital bone defect
Spina bifida	Failure of the closure of the dorsal aspect of the vertebral foramen of one or a few vertebrae
	- Spina bifida occulta (closed spinal dysraphism): involves a hidden vertebral defect and minimal neural involvement
	- No obvious deformity
	- Sometimes a hairy patch of skin or dimple at the expected spinal defect
	- Spina bifida aperta (open spinal dysraphism): defect in which neural tissues communicate with the external environment
	- Meningocele: defect of the posterior elements of the spine with extrusion of meninges and cerebrospinal fluid (CSF) without the involvement of the neural elements
	- Myelomeningocele: clear meningeal cystic sac that contains CSF and nervous tissue
	- Myelocele: clear open defect with no meningeal sac is protruding
Rachischisis	Severe form of spinal bifida
	- Cleft through the entire spine
	- Spina bifida involving many adjacent vertebrae
Encephalocele	Herniation such as a sac-like protrusion of the brain and/or the meninges through an opening in the skull
	- Meningocele: herniation of meninges
	- Encephalomeningocele: herniation of meninges and brain
	- Encephalomeningocystocele: herniation of meninges, brain and ventricle

13. Extremities: overall length, symmetry, contractures, pterygia, joint laxity, deformations, muscular mass, position and creases of digits (syndactyly, polydactyly, clinodactyly, and missing digits), nails (size, curvature, and relation to tip of digits), and palmar and plantar creases.

Examination for hip dislocation or instability should be undertaken. Some extremity deformities are shown in Table 5.

Table 5. Terminology of limb deformities[27, 28].

Anomalies	Gross examination
Limb shortening	
Rhizomelia	Shortening of the extremities, involving the proximal segment (humerus or femur)
Mesomelia	Shortening of the extremities, involving the middle segment (radius, ulna, tibia or fibula)
Acromelia	Shortening of the extremities, involving the distal segment (hands and feet)
Micromelia	Shortening of the extremities, involving the entire limb (proximal, middle, and distal segments)
Acromesomelia	Shortening of the extremities, involving the middle and distal segments
Absence of extremities	
Amelia	Absence of 1 or more limbs
Phacomelia	Shortening of limb with hand/foot arising near trunk (seal limb)
Hemimelia	Absence of distal limb
Acheiria	Absence of the hand
Abnormalities of hands and feet	
Polydactyly	Presence of more than five digits - Postaxial: the extra digits are on the ulnar or fibular side - Preaxial: the extra digits are located on the radial or tibial side
Syndactyly	Soft tissue or bony fusion of adjacent digits
Clinodactyly	Permanent curvature or deflection of one or more fingers
Symbrachydactyly	Fingers are short and webbed or joined together. Some or all of the fingers are typically underdeveloped or missing.
Macrodactyly	Abnormally large fingers
Clubfoot (talipes equinovarus)	Rigid inward turning of foot toward the midline of the body (forefoot and midfoot abductus, hindfoot varus, and ankle equinus)
Rocker bottom foot	Vertical talus, or eversion of the planar arch, produces a rocker-bottom (convex outward) appearance of the bottom of the foot
Clenched hands	The hands are clenched to fists - All digits held completely flexed at the metacarpophalangeal and interphalangeal joints - Overlapping of index finger across other three clenched fingers.
Ectrodactyly	Deficiency or absence of one or more central digits of the hand or foot (split hand, cleft hand, or lobster claw hand)

Examination of the placenta

Many placental lesions can be diagnosed solely by gross examination which is very helpful in evaluation of stillbirth. Several conditions can be detected such as abruption and umbilical cord abnormalities. As the detail of placental examination in delivery room has been published[29], so in this section will discuss some specific points that related to stillbirths.

1. Weighing the placenta in grams

2. Umbilical cord examination: number of vessels at cut end of cord, length, diameter, coiling index, type of cord insertion, knots, and discoloration. Cord stricture can be seen at the fetal end, especially

in macerated stillbirth and misinterpret as the main cause of fetal demise. However, it is controversy and can be postmortem artifact. Some pathologists suggest that the diagnosis of "real" cord stricture as the cause of fetal death should be confirmed by histologic evidence of venous obstruction such as stenosis or obliteration of cord vessels at the narrow segment or intravascular cord thrombosis[30].

3. Examination of membranes: type of insertion into the disk, completeness, color, opacity, and other lesions such as hemorrhage, cysts or nodules. Green brown discoloration reflects meconium-stained amniotic fluid, while red brown discoloration is seen in cases with old hemorrhage. Chorioamnionitis can be seen as opaque membranes with yellow white color.

4. Placental disk examination: assess the shape and extra lobes, disk size (3-dimensions), and evaluate the fetal and maternal surfaces. The fetal surface or chorionic plate is examined for color, vascular pattern and thrombosis, hemorrhage, abnormal nodules, and cysts. The maternal surface or basal plate should be inspected of color, completeness, discoloration, and adherent blood clot.

Conclusion

Gross examination of fetus and placenta should be done in every stillbirth immediately after delivery. The evaluation should be done step by step. Examination of baby is starting from head to toe as well as placental examination that includes three main components: umbilical cord, membranes, and disk.

Potential conflicts of interest

The author declares no conflicts of interest.

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