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National guidelines for delivery room management

Türk Neonatoloji Derneği ulusal doğum salonu yönetimi rehberi

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Abstract

The following guideline is designed to give recommendations for the routine care of all neonates immediately after delivery, and the resuscitation and delivery room approach of all high-risk infants in light of recent literature. The guideline has been prepared as three different parts. The first part is about routine procedures that have to be performed to all healthy term and preterm infants in delivery room care. The second part summaries the basic principles of resusucitation including the latest changes that were mentioned in the International Liaison Committee on Resuscitation (ILCOR)-2015 guideline. Recommendations about the delivery room management of rare clinical conditions have been discussed in the last part. The social, medical conditions, and the resourses of Turkey have also been taken into consideration in its preparation. We hope it will be useful for all pediatricians and neonatologists for use as a essential guideline in delivery room care.

Keywords: Delivery room, newborn, resuscitation

Öz

Bu rehber, yenidoğan bebeklerin doğum salonunda değerlendirilmesi, rutin bakımı ve canlandırma gereksinimi olan yenidoğanlara uygulanacak girişimlerle ilgili en son dizin bilgilerinin ışığı altında hazırlanan önerileri içermektedir. Rehber temel olarak üç ana bölümden oluşmakta, ilk bölümde sağlıklı doğmuş bütün term ve prematüre bebekler için rutin doğum salonu uygulamaları anlatılmaktadır. İkinci bölümde "International Liaison Committee on Resuscitation" (ILCOR)-2015 rehberinde belirtilen en yeni değişiklikleri de içeren doğum salonu canlandırma uygulamasından bahsedilmektedir. Son bölümde ise özel ve bazı nadir klinik durumlarda doğum odası yaklaşımları tartışılmaktadır. Öneriler hazırlanırken ülkemizin koşulları ve kaynakları da göz önünde bulundurulmuştur. Bu rehberin çock hekimleri, yenidoğan hekimleri için yararlı olacağına ve doğum salonu uygulamaları için temel bir kaynak olarak kullanılacağına inanıyoruz.

Anahtar sözcükler: Canlandırma, doğum odası, yenidoğan

Introduction

The first minutes are very important for newborns in terms of making a healthy transition to the postnatal life. Achievement of this is possible with accurate and timely performance of the delivery room application steps for both healthy babies and babies who carry risk and require resuscitation. This guideline, which includes treatments to be performed in newborns requiring resuscitation together with assessment and routine care of newborns after delivery, was prepared in light of recent literature considering the conditions of our country; it is an abridged form of the original guideline.

Part 1

Delivery room procedures in healthy newborns

Preparation for delivery

Evaluation of the expected risks in babies by establishing a perinatal committee together with a pediatrician and an obstetrician before delivery is beneficial in risky deliveries in terms of reducing the mortality and morbidity risk in babies. Knowledge of prenatal risk factors is very important in terms of being prepared for potential problems. In preterm deliveries, it should be interrogated if antenatal steroids have been administered (Table 1).

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Table 1. Maternal conditions that pose prenatal /intrapartum risk and their effects on newborns

Prenatal risk	Effect on the newborn
Maternal diabetes	Hypoglycemia, hypocalcemia, macrosomia, cardiomyopathy
Rh incompatibility	Anemic, hydropic birth
Decreased intrauterine movements	Hypotonic baby
Preeclampsia-eclampsia	Premature delivery, hypoxic birth
Multiple pregnancy	Premature delivery, IUGR, hypoxic birth
Postterm delivery	Birth trauma, hypoxic birth, MAS
Polyhydramnios	Esophageal atresia
Oligohydramnios	Renal anomalies, lung hypoplasia
Premature rupture of membranes	Early sepsis
Maternal age <19 or >35 years	Intrauterine growth retardation, chromosomal disorders, hypoxic birth
Presence of significant fetal malformation or congenital heart anomaly on fetal ultrasonography	Hypoxic birth, apneic, dyspneic or hypotonic baby, baby born arrhythmic
Unmonitored pregnancy	Anything can happen
Fetal bradycardia	Hypoxic birth
Observation of meconium on fetal ultrasonography	Hypoxic birth, MAS
Maternal chorioamnionitis	Premature delivery, early sepsis, fetal inflammatory response
Intrapartum risks	**Effect on the newborn**
Rapid labor	Intracranial hemorrhage
Prolapsus/entanglement of the umbilical cord	Hypoxic birth
Premature separation of the placenta	Hypoxic birth, premature delivery
Suddenly developing fetal bradycardia (<60/min)	Hypoxic birth
Forceps/vacuum delivery	Birth trauma, cephalic hematoma, caput succedaneum
Maternal fever	Fetal tachycardia, respiratory depression at birth
Administration of narcotic analgesic 4 hours before delivery	Baby born depressed with no respiratory effort

IUGR: intrauterine growth retardation; MAS: meconium aspiration syndrome

Even if there are no risk factors, resuscitation equipment should be prepared for each delivery considering that problems necessitating urgent intervention to the baby during or immediately after delivery may arise a qualified individual who knows the initial steps of resuscitation and how to apply positive pressure ventilation (PPV) should be present. In high-risk deliveries, this number should be two including someone who has a Neonatal Resuscitation Program (NRP) certificate and can fully apply resuscitation steps in the delivery room. In multiple pregnancies, this number should be calculated such that two people for each baby are present (1, 2) (Table 2).

According to the World health Organization (WHO) and International Liaison Committee on Resuscitation (ILCOR)-2015 recommendations, the temperature in delivery rooms should be kept at ≥26°C, warm and dry blankets should be prepared before delivery, a radiant heater should be turned on, and a polyethylene plastic bag and cap should be provided, if the baby to be born is preterm (3, 4).

Initial assessment and intervention in the delivery room

Babies with no risk factors in the prenatal history, who a) are born at term, b) have good tone (lower and upper

Table 2. List of equipment required for resuscitation of the newborn

Aspiration materials

- Bulb syringe
- Wall suction
- Suction catheters: 5F or 6F, 8F, 10F, 12F or 14F
- 8 Fr nasogastric catheter and 20 mL injector
- Meconium aspirator

Bag-valve mask materials

- Masks with sizes compatible with terms and preterms
- Self-inflating bag with a volume of 250-270 mL
- Oxygen source
- Air source
- Flowmeter
- Oxygen-air mixer and hoses
- Pulse oximeter and oximeter probe

T-piece resuscitator

Intubation materials

- Laryngoscope and No. 0 (preterm) and No. 1 (term) straight blades
- Spare lamps and batteries for laryngoscope
- Endotracheal tubes – sizes 2.5, 3.0, 3.5, 4.0 mm
- Stylet (optional)
- Scissors
- Tape or endotracheal tube holder
- Gauze with alcohol
- Carbon dioxide detector (if possible)
- Laryngeal mask
- Oropharyngeal cannula

Umbilical vein catheterization materials

- Sterile gloves
- Scissors or bistoury blade
- Antiseptic preparation solution (Povidone iodide)
- Umbilical catheters 3.5 Fr, 5 Fr
- Stopcock
- Injectors – 1, 3, 5, 10, 20, 50 mL
- Needles – No. 25, 21, 18

Drugs

- Adrenaline; 1:10.000 (0.1 mg/mL); prepared by diluting from 1, 0.5, 0.25 mg ampoules (distilled water)
- Volume expander; isotonic crystalloid (normal saline or Ringer's lactate) 100 or 250 mL
- Dextrose 10% - 250 mL
- Normal saline for washing
- Distilled water

Other

- Gloves, caps and other personal protectors
- Cord clamp
- Radiant heater
- Smooth, hard surface for resuscitation procedure
- Watch (chronometer optional)
- Heated towels
- Stethoscope (with drum for newborns preferable)
- Plaster
- Heart monitor and electrodes (if possible)
- Oropharyngeal cannula (with a size of 0, 00, 000 or a length of 30, 40 and 50 mm)

For extremely preterm babies

- Polyethylene bag (big size)
- CPAP cannula with different sizes, ventilator circuit
- Transport incubator to maintain the baby's body temperature during transportation to ward (with ventilator, if possible)
- No. 00 laryngoscope blade

CPAP: continuous positive airway pressure

extremities in the semiflexion posture), c) have adequate respiratory effort at birth and who do not need resuscitation intervention should be considered healthy, and other interventions to be performed in the delivery room for healthy babies should be initiated (4, 5). The Apgar score of these babies in the first and fifth minutes

is between 7 and 10 and they can be given to their mothers without the need for further monitoring. However, the Apgar score may be erroneously perceived as low in relation with maternal sedation or anesthesia, congenital malformations of the baby or low gestational age. Therefore, a low Apgar score alone is not sufficient for the diagnosis of asphyxia in the absence of a supportive history or physical examination findings (4, 6).

Cord clamping and cutting

All term and preterm babies who do not need resuscitation should be held at or below the level of the mother for at least 30 seconds before cord clamping (4). Randomized controlled studies have shown that blood pressure and cerebral oxygenation are better in the first 24 hours, iron stores are better in the long term, and transfusion requirement and the frequencies of intraventricular hemorrhage and necrotizing enterocolitis are lower with delayed clamping compared with immediate clamping. The only known unfavorable outcome related with delayed clamping is occurrence of higher bilirubin levels. In babies who require resuscitation, the time of cord clamping has not yet been clarified (7-10). The International Liaison Committee on Resuscitation-2015 presented suspicions about the use and reliability of milking (regardless of the baby's level with regard to the mother, milking or stripping the cord towards the baby for 3-4 times) to keep the time period shorter in preterm babies (4).

In cases where urgent intervention to the mother is required or resuscitation of the baby cannot be performed appropriately in the operation area, the milking may be preferred both in term and preterm (≥29 weeks) babies (4).

The umbilical cord should be clamped with a sterile, disposable cord clamp 4-5 cm away from the skin, cut by holding with a sterile gauze, and its tip should be wiped once with povidone iodine. Application of povidone iodine should be limited to the tip of the cord; it should not be applied on the skin.

Head positioning and aspiration

The most appropriate position in keeping the airway open is mild extension of the head. A rolled towel or blanket may be placed below the shoulders to maintain the correct position.

Suction should not be routinely applied to all babies. Babies with strong respiratory effort, good muscle tone, and an heart rate (HR) above 100 /min should be defined as 'vigorous' and it is sufficient to wipe the inside of the mouth and nose with sterile gauze in these babies. Suction of the mouth and nose should only be performed in babies with large amounts of secretion who are thought likely to develop respiratory difficulty. A bulb syringe or suction catheter should be used for aspiration and the negative pressure (vacuum) should never be increased above 80-100 mm Hg while using an aspirator. Suctioning is a stimulus which initiates respiration for the baby. If it is applied in the nose primarily, the baby may aspirate the content inside the mouth by starting to breath. Therefore, it is recommended that the mouth should be suctioned firstly and subsequently the nostrils should be suctioned. Repetitive suctioning is wasted effort; twice at most are sufficient. Very deep suctioning should be avoided. If bradycardia occurs during suctioning of the nasopharynx, it should be stopped and HR should be reevaluated (4, 5, 11, 12).

Drying and prevention of hypothermia

Term babies should be dried starting from the head using dry and warm blankets after delivery, wet blankets should be removed and a cap should be put on the head, which covers the ears. Skin contact by laying the baby on the mother's body such that baby is facing the mother and covering the baby's back with warm blanket are also important in preventing hypothermia (4, 13).

Studies have shown that covering preterms n plastic wrapping after delivery plays a role in the prevention of hypothermia. Therefore, preterm babies who are born with a gestational age of <30 weeks should be placed in polyethylene plastic bags immediately after delivery without drying, a cap should be put on their heads and they should be placed under a radiant heater or in an incubator. A similar application can be performed in preterms born with a gestational age of ≥30 weeks, but one should pay attention not to create hyperthermia (>38°C). Thermophore, surgical gloves or hot water packs should never be used to warm the baby because they can lead to burns (4, 14, 15).

Important warning

Applications related with head positioning, aspiration, and drying, which are considered starting steps in delivery room (except for tactile stimulus) are applied both in healthy newborns and in babies who require resuscitation after delivery (4, 5) (Figure 1).

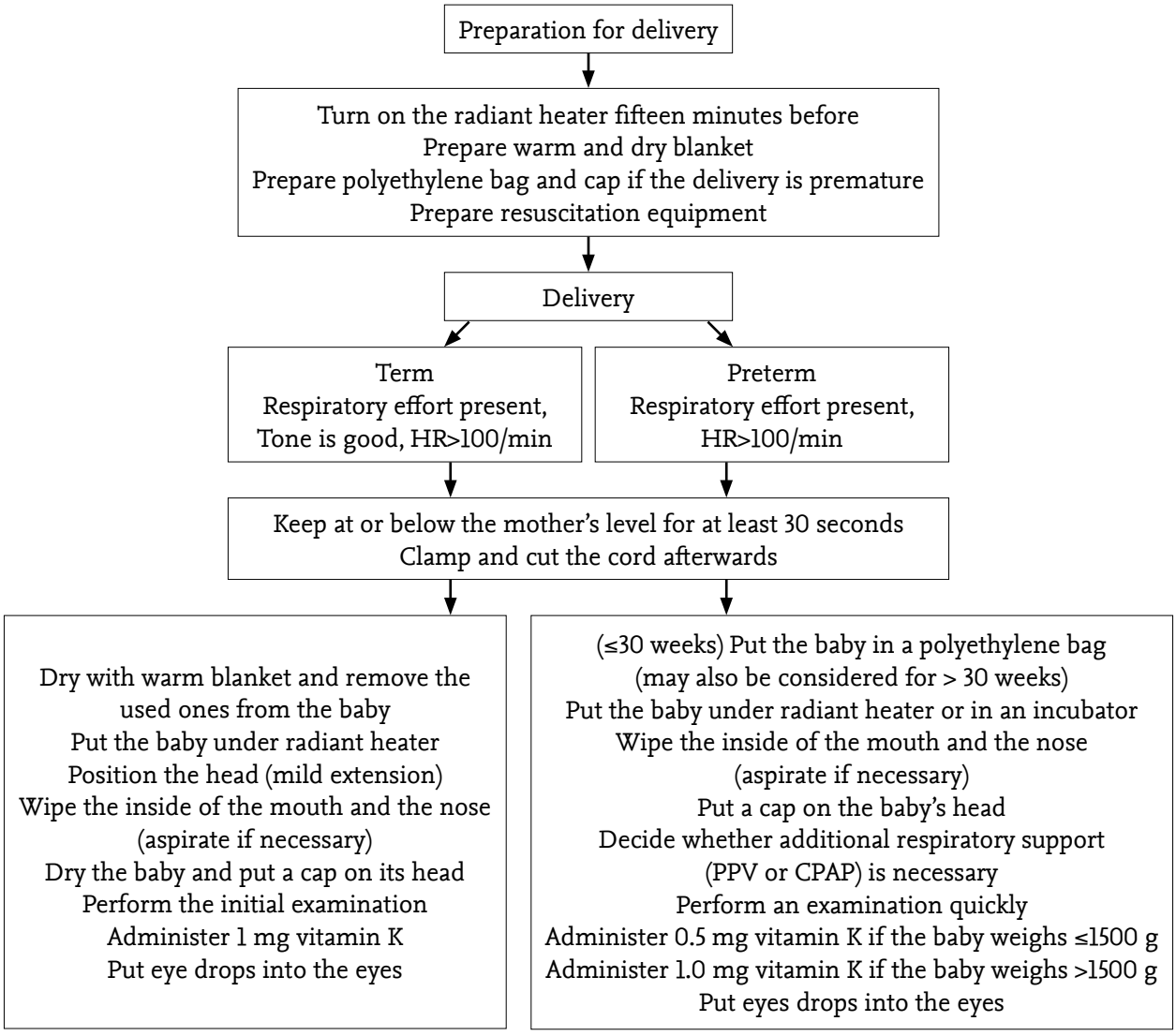

Figure 1. The primary steps after delivery in deliveries with no risk factors

HR: heart rate; PPV: positive pressure ventilation

Umbilical cord applications

It is recommended that an umbilical cord blood sample should be obtained in preterm delivery or meconium delivery, vaginal delivery, in shoulder or transverse presentations with risk of trauma, in the presence of intrapartum maternal fever (>38°C) or hemorrhage, in severe intrapartum cardiotocography disorders, and in cases where the Apgar score is ≤5 in the 5th minute. For this objective, the umbilical cord is clamped and separated from the placenta by cutting. The cord is clamped for a second time leaving 10 cm between the second and first clamp and blood is obtained from the cord from the umbilical artery in between the clamps into a heparinized injector (pH and blood gases values of the blood in the clamped cord segment can be maintained stable at room temperature for 30 minutes). It should be kept in mind that the umbilical artery appears more obscure because its lumen is smaller and contains less blood compared with the vein and the blood sample should be obtained from the umbilical artery rather than the umbilical vein in order to determine neonatal oxygenation status. The most important parameters in assessment include pH and base excess, which indicate metabolic acidosis. In the blood gases tested in the cord blood, a pH value of <7.0 indicates marked fetal acidemia, a base excess of 12-16 mmol/L indicates that the baby is hypoxic and a base excess value of >16 mmol/L suggests that the baby has been exposed to severe hypoxia.

Eye care and administration of vitamin K

The most common infectious agents transferred to newborns from the vaginal canal include Chlamydia

Trachomatis and Neisseria Gonorrhoeae. As yet, no preparations have been recommended for prophylaxis. One percent silver nitrate, 0.5% erythromycin, 1% tetracycline hydrochloride or povidone iodine is used, which varies by country. The Canadian Pediatric Society, the National Institute for Health and Care Excellence (NICE), and the Center of Disease Control and Prevention (CDC) recommend eye drops containing 0.5% erythromycin for prophylaxis in the first place, but they state that this recommendation is especially for prophylaxis of Neisseria Gonorrhoeae. In countries where erythromycin is not available, use of 1% azithromycin is recommended, and in countries where neither are available, use of 0.3% gentamycin or 0.3% tobramycin is recommended despite topical adverse effects (swelling in the palpebrae, dermatitis around the eye) (16-21).

In our country, eye drops containing 0.5% erythromycin are not available; therefore, use of 1% azithromycin, 0.3% gentamycin or 0.3% tobramycin is recommended. Eye drops should be dropped into the lower palpebrae (1 drop in each eye) and the overflowing amount should be wiped away to prevent topical adverse effects.

Placental transfer of maternal vitamin K to the fetus is very limited and cord blood levels in healthy newborns are below 0.02 ng/mL, which is the detectable lower limit. Vitamin K levels in breastmilk are also low. Randomized controlled studies have definitively shown that administration of vitamin K at birth prevents early or classic hemorrhagic disease. It is currently recommended that a single dose of intramuscular (IM) 1 mg vitamin K should be administered at birth or on the first day in term babies (22).

There is no definite dose recommended for preterms as yet. The internationally recommended doses vary between 0.3 and 0.4 mg/kg. The Canadian Pediatric Society-Neonatology Committee recommends administration of 0.5 mg vitamin K (IM) in babies born with a birth weight 1500 g or below and 1.0 mg vitamin K (IM) in babies born with a birth weight above 1500 g (23). Currently, it is appropriate to administer a single dose of 0.5 mg vitamin K (IM) in babies born with a birth weight 1500 g or below and a single dose of 1.0 mg vitamin K (IM) in babies born with a birth weight above 1500 g in terms of ease of implementation.

Initial examination and other applications (bathing and identification procedure) in the delivery room

The assessment of gestational age in the delivery room is based on prenatal follow-up data (the date of the last menstrual period, fetal ultrasonography findings) given by the obstetrician who has carried out the delivery. A basic initial examination is performed to determine the presence of any severe problems. It is appropriate to perform the examination after the cord is cut and when primary step applications have been completed. The examination encompasses vital findings, height, weight and head circumference measurements, general appearance, extremity movements, heart-lung auscultation, and evaluation of the presence of birth trauma and congenital malformations.

In a baby with sufficient respiratory effort, cyanosis in the tips of the extremities and nailbeds is generally related with vasoconstriction arising from insufficient peripheral warming. Therefore, oxygen administration should not be initiated immediately and the baby should be left to continue to inspire room air. In babies who develop signs of dyspnea following delivery, it should be checked if the nostrils are open in terms of coanal atresia besides the respiratory system.

The Apgar score in the first and 5th minutes gives information about the newborn's health status, but this information is not sufficient to determine long-term prognosis and is not significant by itself.

The baby should also be checked in terms of birth traumas (caput succedaneum, cephalic hematoma, peripheral facial palsy, clavicular fracture, brachial plexus injury). Murmurs heard after delivery are usually innocent and transient. Inability to palpate femoral pulses is significant in the diagnosis of aorta coarctation (24).

The first bath should not be performed before the postnatal 24th hour to enable heat stabilization. Bathing should be delayed in preterm babies because heat stabilization occurs later and is harder in these babies, but there is no recommendation regarding timing. Babies born from hepatitis B, hepatitis C, and HIV-positive mothers should be washed immediately after delivery with soap and water because maternal secretions increase the risk of viral transmission to the baby and vitamin K should be administered after bathing.

One of the two wrist bands prepared before delivery should be put on the baby's wrist (blue for boys and pink for girls) after delivery such that it will not be detached and the maternal name and surname, medical record number, and the baby's date of birth should be

written on this band. Prints of both the baby's feet and the mothers right thumb should be obtained and kept in the baby's file.

Babies who are stable should be shown to their mothers immediately and put on the mother's breasts to start skin-to-skin contact within a half-hour and encouraged to be breastfed, if possible (24).

Part 2

Resuscitation in the delivery room

Viability limit in the procedure of resuscitation

Based on the available data, preterms born below 22 weeks of gestation are not considered 'viable' by many centers. Resuscitation intervention should be performed in babies born with a gestational age of 25 weeks and above. There are as yet no clear recommendations for babies born with a gestational age of 220/6 -246/7 weeks (25-27).

The legal regulations in our country also consider a gestational age below 22 weeks abortus, but propose that each baby who displays any sign of vitality regardless of gestational age should be given a "right to live" and resuscitation should be performed in these babies (28).

The initial steps in resuscitation

Head positioning, clearing the airway, and drying, which are the starting steps (except for tactile stimulus) are the commonly performed steps both in babies who are born in a healthy status and in babies who require resuscitation after delivery. Resuscitation intervention may be necessary in newborns in whom a negative answer is obtained to the following questions: "Is the baby term?" "Does the baby have good tone?" and "Is the baby breathing or crying" The starting steps should be completed in a shorter time in babies who need resuscitation compared with healthy babies (4) (Figure 2).

Approach to babies with meconium-stained amniotic fluid

Intrapartum tracheal suctioning is no longer performed because it leads to apnea, bradycardia with vagal stimulus, delayed resuscitation, and injury in the palate and pharynx, and it does not prevent meconium aspiration syndrome (MAS). Regardless of being thick or thin, intrapartum oropharyngeal and nasopharyngeal suctioning should not be performed in babies with meconium stained amniotic fluid (MSAF). Routine tracheal suctioning should not be performed in babies born with MSAF even if the baby is depressed and PPV should be initiated immediately, if the baby's respiratory effort is not sufficient or the HR is <100/min [as observed on three- channel electrocardiogram (ECG), if possible] after completion of the starting step applications (4).

The only indication for tracheal aspiration in babies born with MSAF is the presence of particles that could lead to obstruction in the respiratory tract. If this indication is present, a laryngoscope should be placed to clear the meconium and the glottis should be primarily visualized by cleaning the mouth and hypopharynx with a 12/14-Fr suctioning catheter. An endotracheal tube (ETT) should be placed in the trachea and the ETT should be used as an suctioning catheter by connecting it directly to an aspirator with a meconium aspirator. Meconium particles cannot be cleaned by intra-tube suctioning performed by passing a suction catheter through an endotracheal tube (4).

Tactile stimulus

Drying and cleaning the airways performed in the starting steps are stimuli for respiration at the same time and these steps are sufficient to initiate respiration in most babies. Stimuli including rubbing the back or flicking the soles of the feet should be given in babies in whom respiratory effort does not begin with wiping/suctioning of the inside of the mouth and drying. Excessively harsh stimuli are useless and may lead to severe injury. The baby should never be shaken. Applying tactile stimulus to a newborn who has no spontaneous respiration for a long period will lead to loss of very valuable time. PPV should be initiated immediately in persistent apnea (4).

Assessment of the baby after the starting steps

The baby should be evaluated after the starting steps and tactile stimulus, if needed, in order to determine whether further resuscitation interventions are necessary. The indicators to be used in the assessment include respiratory rate and heart rate. Breathing in the form of gasping is inefficient and should be evaluated as apnea. The HR should be ≥100/min to be considered sufficient in the assessment (4). A pulse oximeter should be connected and PPV should be initiated in a baby who does not have spontaneous respiration (or has insufficient respiration despite tactile stimulus or who has a HR of <100/min (as observed on 3 channel ECG, if possible) on the evaluation performed after the

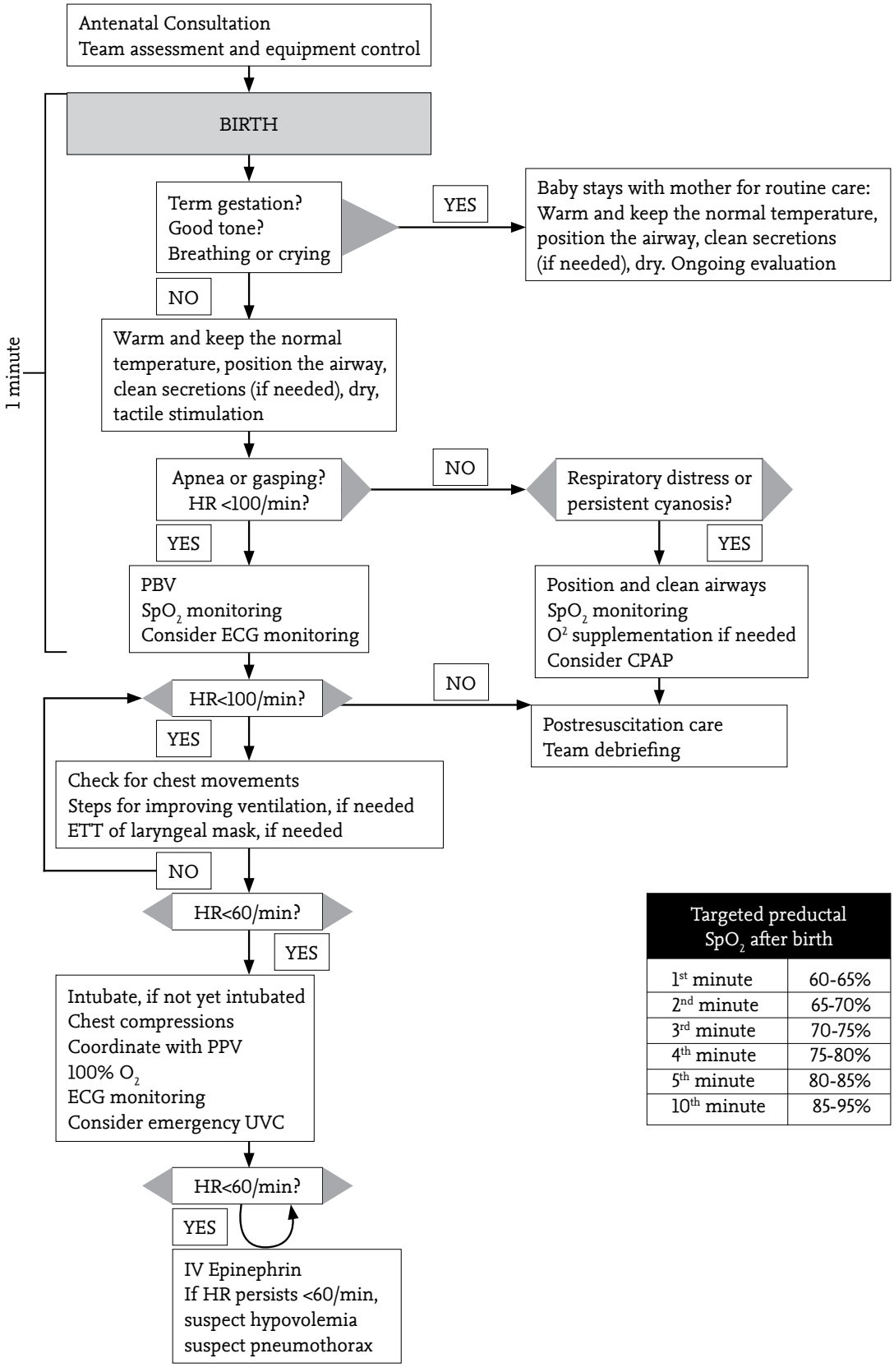

Figure 2. Neonatal resuscitation algorithm (ILCOR-2015) (4)

CPAP: continuous positive airway pressure, ECG: electrocardiography, ETT: endotracheal tube, HR: apical heartbeat, PPV: positive pressure ventilation, UVK: umbilical venous catheterization

initial steps. Free-flow oxygen administration or prolonged tactile stimulation in these babies is not helpfull and delays appropiate intervention.

Administration of supplementary oxygen

In the routine transition period, the increase of O_2 saturation of babies from intrauterine values (50%-60%) to normal values (90-95%) may take up to ten minutes. Oxygen should not be administered immediately following delivery in term babies who are active and have sufficient respiratory effort at birth but who are cyanotic, and time should be given to complete the normal transition period. It is sufficient to monitor these babies as long as respiratory effort is present and cyanosis disappears in minutes.

Free flow oxygen administration

Oxygen may be beneficial if the baby has respiratory effort but has difficulty in breathing, grunting/intercostal retractions are present or persistent central cyanosis and hypoxia confirmed with an oximeter connected to the right upper extremity are present. Free flow oxygen administration should be initiated at low doses using an air-O_2 blender and the dose should be incremented according to the values shown by the pulse oximeter and the baby's status. Target SpO_2 values should be considered while incrementing O_2 (Figure 2). Free oxygen can be administered using an O_2 mask, an aesthetic reservoir bag and mask or a T-piece resuscitator or oxygen hose held close to the baby's mouth and nose. It is not applied with the mask connected to a self-inflating balloon. The mask should be close to the face in all methods. However, increased pressure may be harmful if the mask is pressed down on the face (4).

If the baby's oxygen need continues following resuscitation, although breathing is sufficient and HR has reached normal values, O_2 concentration should not be immediately increased to 100% and it should be incremented considering the target SpO_2 values recommended according to pulse oximetry and minutes.

Short-term O_2 to be used during resuscitation may be dry and unheated, but it should not be given with a high flow rate (above 10L/min) because heat loss and dried mucosae may be significant problems. It is sufficient to apply free oxygen at a rate of 5 L/min (4).

Free flow oxygen is reduced gradually when central cyanosis disappears or the oximetry saturation reaches 90-95%, and is discontinued when the saturation remains stable in room air.

Positive pressure ventilation

If the baby has apnea/gasping, PPV should be applied if HR is <100/min or persistent central cyanosis and low SpO_2 are present despite application of 100% free-flow oxygen even if respiration is present. In term newborns, PPV should be initiated with 21% O_2 (room air). Initiation with a slightly higher concentration (30% O_2) is recommended in preterms. Pulse oximetry should be used during oxygen supleementation.

In newborns, PPV may be applied using a self-inflating balloon, anesthetic reservoir bag or T-piece resuscitator. A T-piece resuscitator is the preferred method in terms of providing both 'peak inspiratory' (PIP) and 'positive end-expiratory pressure' (PEEP). Respiratory support with PPV should be at a rate of 40-60/min (20-30 compressions/30 sec). A PIP/PEEP setting of 20/5 cm H20 should be used in babies with insufficient respiratory effort. In babies with no respiratory effort, higher PIP pressures (30-40 cm H_20) are needed in the first few breaths. Subsequently, the PIP/PEEP pressures should be set at 20/5 cm H20 and pressure change should be made such that it is sufficient to improve the heart rate and to increase oxygen saturation during ventilation (if PPV is being applied with balloon-mask, the same criteria may be used with the objective of increasing the squeezing pressure). While applying PPV, a mask with a size appropriate for the baby's face should be used and the mask should be in full contact with the face.

If respiratory sounds cannot be heard bilaterally and there is no chest rise, the following steps should be tried: adjust the mask to ensure a good seal, reposition the airway by adjusting the position of the head, suction the secretions in the mouth and nose, open the mouth slightly, increase the PIP and consider an alternative airway (endotracheal intubation or laryngeal mask airway).

Measures of adequate ventilation are prompt improvement in heart rate, increased oxygen saturation and initiation of spontaneous breathing.

Important warning

The time period between the initial steps applications and the end of PPV (until the end of the second evaluation) should not exceed 60 seconds. The initial steps should be kept shorter in babies who need resuscitation.

Table 3. Appropriate ETT sizes according to birth weight and gestational ages

Tube (internal) diameter (mm)	Weight (g)	Gestational age (weeks)
2.5	Below 1000 g	Below 28 weeks
3.0	1000-2000 g	28-34 weeks
3.5	2000-3000 g	34-38 weeks
3.5-4.0	Above 3000 g	Above 38 weeks

ETT: endotracheal tube

Chest compression (60 seconds)

Chest compression should be started if the HR is <60/min despite adequate ventilation. One hundred percent oxygen should be given during cardiac massage. Compressions should be delivered on the lower third of the sternum. The 2 thumb-encircling hands technique is recommended. There should be a 3:1 ratio of compressions to ventilations with 90 compressions and 30 breaths per minute.

While applying chest compression, it should be assured that i) chest movements are sufficient during ventilation, ii) the compression depth is 1/3 of the anter-posterior diameter of the chest, iii) the chest is allowed to expand fully in the 'let go' period of compression, iv) the thumb or fingers are never removed from the chest wall, v) the compression part is shorter than the 'let go' part, vi) compression and ventilation are coordinated.

The heart rate should be evaluated after compression and ventilation are performed for 60 seconds:

- If the HR is ≥60/min, compression should be discontinued, but PPV should be continued until the HR is ≥100/min by checking the HR every 30 seconds.
- If the HR is ≥100/min, compression should be discontinued and PPV should also be terminated if there is sufficient and active spontaneous respiration through checking the baby's respiration.
- If the HR is <60/min the baby should be intubated, if not performed before, and a safer way for ventilation should be provided. Adrenaline should also be given at this time (4).

Intubation

Intubation may be performed in order to enhance the coordination between compression and ventilation and to increase the effectivity of ventilation in special conditions including failure of balloon mask ventilation, prolonged need for balloon mask ventilation, aspiration of meconium particles causing obstruction in the respiratory tract, extreme prematurity, requirement for surfactant administration, and diaphragm hernia. The appropriate laryngoscope blade size is 1 for term newborns, 0 for preterms, and 00 for extremely preterm babies. The laryngoscope should always be held in the left hand and the intubation procedure should be completed in 30 seconds by selecting the appropriate size (Table 3).

According to the International Liaison Committee on Resuscitation-2015 recommendations, the best indicator that shows that the endotracheal tube is inside the trachea is detection of CO_2 in exhaled breath by endotracheal carbon dioxide detector (ET-CO_2). However, the following should be considered as signs showing that the tube is placed accurately when ET-CO_2 monitor is not available.

- Improvement of vital signs (heart rate, color/oxygenation, movement)
- Presence of respiratory sounds on both lung areas, absence of respiratory sounds on the stomach
- Absence of gastric distention during ventilation
- Condensation in the endotracheal tube during exhalation
- Elevation and chest movements of the chest in each breath
- Observing directly that the tube is passing between the vocal cords

If the tube is to stay where it is following initial resuscitation, it should be checked if the tube is in the right place (middle of the trachea) with lung imaging.

Laryngeal mask: A laryngeal mask may be applied if there is a malformation in the face or upper respiratory tract that will reduce efficiency of ventilation with a mask or if PPV cannot be performed efficiently with mask, but there is no opportunity for intubation. However, its use still remains limited because appropriate sizes are not available for preterms younger than 34 weeks, air leakage between the larynx and mask may result in insufficient pressure in the lung. However, use of the laryngeal mask has not been evaluated durig chest compressions or for administration of emergency medications (4).

Medications

If AHP is <60/min despite adequate ventilation and chest compression for sixty seconds, adrenaline should

be administered. The administration should be performed rapidly at a dose of 0.1-0.3 mL/kg from a solution with a concentration of 1/10,000 (0.1 mg/mL) by the intravenous route. The first adrenaline administration may be performed by the endotracheal route until venous access is established, but the dose should be higher (0.5-1 mL/kg).

Volume expansion may also be given if the baby does not respond to resuscitation, if the baby is observed to be in shock (paleness, weak pulse, persistent low heart rate, absence of improvement in circulation despite resuscitation), and if there is a history of blood loss (e.g., excessive vaginal hemorrhage, placenta previa, twin-to-twin transfusion). Normal saline is recommended and should be administered intravenously at a dose of 10 mL/kg over 5-10 minutes.

Naloxone hydrochloride is not recommended as part pf the initial resuscitation for newborns with respiratory depression in the delivery room anymore in the International Liaison Committee on Resuscitation-2015 recommendation (4).

Discontinuation of resuscitation

Resuscitation can be terminated if the baby does does not respond to continous and adequate resuscitation interventions for 10 minutes (Apgar value 0, heart beat or respiratory effort absent), but this recommendation may not be applied in the same way for each baby and may be changed according to the baby's status.

Part 3

Delivery room management of high-risk newborns

Varying levels of resuscitation steps need to be applied in the delivery room in 10% of all deliveries and advanced resuscitation needs to be applied in 1%. The first condition for efficient resuscitation is to be prepared. It is important to know identify high-risk deliveries with high risk before in order to predict the need for resuscitation (Table 1).

IIn high-risk deliveries, mode, timing, and place of delivery should be planned carefully in order to provide an appropiate level of care. Obstetricians and physicians of relevant specialties should be consulted for this.

If a need for resuscitation in the delivery room is predicted, an interview with the family must be made prior to delivery if possible.

Delivery roommanagement of babies born hypoxic

The objective in the delivery room in terms of babies born hypoxic is to provide adequate perfusion of the brain and other organs in order to prevent long-term sequelae (29). Hyperoxia in particular should be avoided when applying resuscitation steps because it will increase reperfusion injury caused by free oxygen radicals in the brain and myocardium. An oxygen-air blender and pulse oximeter must be used (30, 31). The arterial carbon dioxide level should be kept within the normal limits ($PaCO_2$: 35-45 mm Hg) because it affects cerebral blood flow. Blood gases should be closely monitored after initial stabilization. It is also important to avoid hyperthermia and hypoglycemia.

Volume loading frequently occurs in babies who develop multiorgan injury with interruption of placental blood flow. Volume expansion should be used carefully in the delivery room in these babies (29).

It should be assured that these babies are cared up in a center where their systemic and cerebral functions can be monitored following initial resuscitation and stabilization and subsequent treatments should be planned rapidly.

In term and near-term babies with moderate-severe hypoxic ischemic encephalopathy, therapeutic hypothermia is a treatment method with proven efficiency and it should be performed according to the recommended treatment protocols in centers that possess the required technical equipment or these babies should be referred to a center where therapeutic hypothermia can be applied after initial stabilization, if necessary.

Delivery room management of preterm babies

Very low birth weight infants display the need for resuscitation in the delivery room with a higher probability and complications related with resuscitation are observed more frequently in these babies. Therefore, 'lung protecting strategies' recommended to decrease lung damage should be initiated immediately after delivery (32).

Resuscitation: PPV (T-piece resuscitator), in which PIP and PEEP are applied in combination should, be preferred while performing respiratory support in preterm babies with no or weak respiratory effort in order to provide sufficient gas exchange and establish an appropriate functional residual capacity. Keeping the first

1-2 compressions above 5 seconds while applying PPV is beneficial in terms of transfer of intra-alveolar fluid to the lymphatic system and increasing functional residual capacity. It is recommended that a PIP of 20-25 cm H_20 and a PEEP of 5 cm H_2O should be used in PPV (2, 32).

CPAP: In all preterm babies with respiratory distress symptoms after delivery, but whose spontaneous respiration is sufficient, nasal CPAP should be applied in the delivery room. It is appropriate to initiate CPAP in the delivery room in all preterm babies with a gestational age of <32 weeks and a birth weight of <1500 g even though respiratory distress is absent. Short binasal prongs and a pressure value of 5-6 cm H_2O should be preferred for nasal CPAP. A T-piece resuscitator may also be used for this objective (32-34). CPAP should be continued during transport to the intensive care unit in preterm babies in whom CPAP has been initiated in the delivery room.

Oxygen: Meta-analyses of studies related with use of high (50-100%) and low (21-30%) concentration oxygen during resuscitation in delivery room have shown that use of high concentration oxygen increases mortality in babies with a gestational age below 32 weeks. In extremely preterm babies, hyperoxia has been shown to increase chronic lung disease and retinopathy of prematurity, and low O_2 saturation (85-89%) increases the mortality rate and the frequency of necrotizing enterocolitis. In conclusion, the optimal oxygen saturation is still controversial in very-low-birth- weight preterms even for the period in delivery room. Therefore, it is currently recommended that the targets determined for term babies (90-95%) should also be used for preterm babies immediately after delivery (35-37).

In preterm babies, both hyperoxia and hypoxia should be prevented. It is recommended that initiating resuscitation with a low oxygen concentration (21%-30%) and oxygen saturation should be adjusted according to SpO_2 levels in babies with a gestational age of <35 weeks in the ILCOR-2015. Saturation values by connecting a pulse oximeter.

Prophylactic surfactant: The results of recent studies together with the widespread use of antenatal corticosteroids and adoption of novel ventilation techniques do not support prophylactic surfactant in the delivery room in preterm babies. Therefore, prophylactic surfactant use is presently recommended only in preterms in whom antenatal steroids have not been used, who are younger than 26 gestational weeks or who need intubation for stabilization in the delivery room (2, 37).

Intubation, surfactant administration, reextubation for nasal CPAP (INSURE) and less invasive surfactant administration (LISA) are two techniques that are being used increasingly for surfactant administration, but these methods require experience and studies related with the use of these techniques in preterm babies in delivery room are still continuing (37, 38).

Delivery room management of babies with hydrops fetalis

Because intubation is frequently needed in babies born hydropic and paracentesis and thoracentesis may also be required, if adequate ventilation cannot be provided despite intubation, a three-member team including an experienced person to perform paracentesis and thoracentesis should be ready in the delivery room.

Umbilical artery and vein catheterization should be performed urgently. If severe fetal anemia is predicted, O Rh (-) erythrocyte suspension should be kept ready in the delivery room having performed cross-match with maternal blood. If the hematocrit value measured in the cord blood immediately after delivery is found as <35%, partial blood exchange should instantly be performed with an erythrocyte suspension. Pleural effusion, ascites samples, and cord blood samples must be stored in terms of diagnosis and the placenta should be stored for histopathologic examination (39, 40).

Delivery room management of babies born from Hepatitis B-carrier mothers

The decision for delivery by elective cesarean section should be made individually for each mother depending on maternal antiviral treatment and viral DNA load in the 3rd trimester. Babies of HBs Ag-positive mothers should be bathed immediately after delivery to remove blood and fluids contaminated with HBV. Hepatitis B immunoglobulin (HBIG) 0.5 mL IM should be administered in the first 12 hours and hepatitis B vaccination should be performed in the first 24 hours in these babies. If the mother's carrier state is not known, hepatitis B vaccination should be performed in the first 12 hours, the mother's test results should be awaited and HBIG should be administered to the baby as soon as possible if the mother is found to be HBs Ag (+). In babies with a birth weight of <2000 g, immunoprophylaxis should be performed in the same way, but the first

hepatitis B dose should be disregarded and vaccination should be completed with three more doses (41, 42).

Delivery room management of other high risk conditions

Congenital diaphragmatic hernia: PPV with a balloon-mask should be avoided after delivery. The baby should be intubated immediately and low pressures should be applied (≤25 cm H_2O) during PPV to reduce lung injury. A nasogastric catheter should be placed, continuous aspiration should be initiated, and an umbilical venous catheter should be inserted. A thoracostomy tube and drainage system should be kept ready in the delivery room because pneumothorax may develop during PPV (43).

Pneumothorax: In babies who do not respond to PPV during resuscitation, pneumothorax should suspected when reduced respiratory sounds are heard on one side, asymmetry is found in the chest, and heart sounds are shifted to the other side. The definite diagnosis is made with lung imaging, but transillumination may be helpful in the diagnosis. In an emergency, thoracentesis should be performed in the delivery room (44).

Meningomyelocele: Babies who have been diagnosed as having meningomyelocele are frequently delivered by cesarean section. Vaginal delivery can be performed if the baby has a small defect. The newborn infant should be placed in prone or side-lying position to protect the exposed neural elements and prevent rupture of the membrane covering the defect. Sterile saline-soaked gauze should cover the defect, after which a plastic wrap covering should be applied. If surgery is not going to be performed immediately, the tissue should be continuously kept damp. The general principles of resuscitation should be applied (45).

Abdominal wall defects: The sac should be covered with warm sterile saline-soaked gauze and a plastic dressing on top. In gastrochisis, the baby should be laid on their right side and the sac should be kept in the midline to prevent bending of the mesenteric artery. Attention should be paid to thermoregulation. Continuous suction should be initiated by placing a nasogastric catheter. Umbilical catheterization is not appropriate, but peripheral vascular access must be obtained in the delivery room. If respiratory distress develops, PPV with a balloon-mask should not be performed and the baby should be intubated and resuscitation steps should be applied. It should be kept in mind that accompanying cardiac anomalies, lung hypoplasia, and other anomalies may be present, especially in cases of omphalocele (45).

Heart disease diagnosed prenatally: In pregnancies in which the presence of congenital heart disease has been determined with fetal echocardiography, a committee consisting of a perinatologist, neonatologist, pediatric cardiologist, and pediatric cardiovascular surgeon should be established and the baby's status and expectations should be discussed. Babies in whom an intrauterine diagnosis of major or critical congenital heart disease has been made should be delivered in a center that possesses a tertiary level neonatal intensive care unit.

Spontaneous labor and preferring vaginal delivery are appropriate, but rarely, preterm delivery may be needed in cases including hydrops fetalis. In most patients, advanced resuscitation is not required in the delivery room. In babies who develop bradycardia and cyanosis, respiratory causes should be considered before cardiac causes.

In d-transposition of the great arteries in association with restrictive atrial septal defect or hypoplastic left heart syndrome, which are rare conditions for which urgent intervention may be needed after delivery, the appropriate approach includes planned cesarean section and attendance of a pediatric cardiologist and a cardiovascular surgeon in the delivery room.

In doctus dependent congenital heart diseases, prostaglandin E_1 infusion does not need to be initiated in the delivery room because it may lead to apnea (46).

Evaluation of the placenta

The placenta should be examined macroscopically in terms of umbilical cord, membranes, and placental disc anomalies. On a minimal examination, the number of cord vessels, cord length, color of the membranes, and presence of observable pathologies (focal pathology, multiple lobes) should be noted, placental weight should be measured, and if possible, and all this information should be included in the medical records of both the mother and baby. The placenta should be submitted for histopathological examination if an abnormality is detected or certain indications are present (47, 48) (Table 4).

In cases of fetal or neonatal mortality, placenta examination is one of the essential components of autopsy.

Table 4. Indications for placental histopathological examination

Maternal diseases with potential fetal effects	Preterm or postterm delivery
Hemorrhage in the third trimester or postpartum hemorrhage	Peripartum fever or infection
Severe oligohydramnios or polyhydramnios	Thick meconium
Invasive intervention where placental injury is suspected	Intrauterine fetal treatment
History of exposure to drug or toxin	Maternal trauma
Prolonged premature rupture of membranes	Stillbirth or neonatal death
Placenta previa or abruptio placenta	Maternal death
Depressed newborn	Hydrops fetalis
Multiple pregnancy (including 'vanishing twin')	Neonatal convulsion
Small or large for gestational age newborns	Umbilical cord anomaly
Congenital anomaly	Neonatal hematologic problems
Placental anomaly	

The placenta can be stored at 4°C (not frozen) for 3-7 days. In cases where culture is required (for example, stillbirth), fetal blood or lung is preferred rather than the placenta. It is recommended that a small piece of the placenta should be stored in normal saline in a refregirator for specific tests before putting the placenta in fixative solution (47, 48).

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