4. BASIC LIFE SUPPORT IN INFANTS AND CHILDREN

Branka Polić, PhD

Basic life support (BLS) involves a systematic approach to initial patient assessment, the initiation of cardiopulmonary resuscitation (CPR) and activation of emergency medical services. BLS can be performed by healthcare providers, as well as by trained lay persons.

Cardiopulmonary arrest among infants and children is typically caused by hypoxia and acidosis as the result of respiratory and/or circulatory failure. This is in contrast to adults, for whom the most common cause of cardiac arrest is ischemic cardiovascular disease.

The International Liaison Committee on Resuscitation (ILCOR) published updated guidelines for pediatric basic life support (BLS) in 2020. For the purposes of these guidelines, a newborn is defined as from birth to one month, an infant is younger than one year of age, and a child is from one year to the puberty. The guidelines are designed to be simple, practical, and effective.

BASIC LIFE SUPPORT

Initial approach – **SSS** approach.

SAFETY: Approach with care and free from danger. The rescuer must ensure that the scene is safe for them and the victim. The rescuer does not become a second victim and the child is removed from danger.

STIMULATE: Gently apply a stimulus. Holding the head and shaking the arm, ask the child: Are you all right? The child makes a sound or opens the eyes or is unresponsive (picture 1).

Picture 1

Stimulating the child

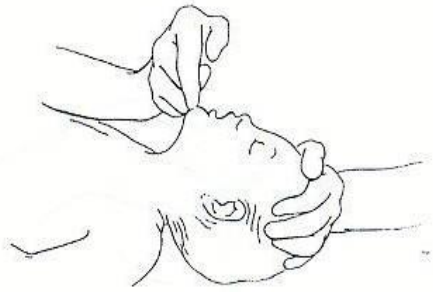
SHOUT: Shout for help if the child is unresponsive. If someone joins you, they will immediately call an ambulance with their mobile phone; if you are alone, you will call an ambulance.

Initiate CPR—The actions that constitute cardiopulmonary resuscitation (CPR) are opening the airway, providing ventilations (rescue breaths), and performing chest compression. The chin-lift and/or jaw-thrust maneuvers should be performed to open the airway in an unresponsive child.

AIRWAY OPENING MANOEUVRES

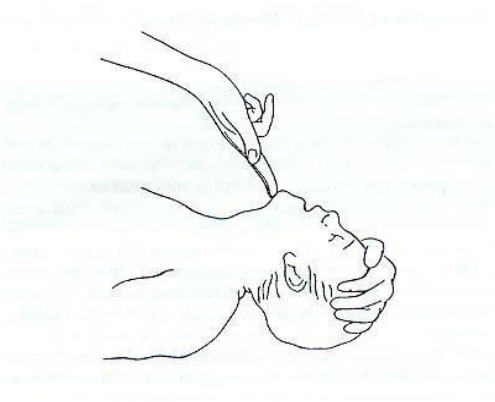
Head-tilt-chin lift—In this technique, one hand may be placed on the child's forehead to gently tilt the head back, and the fingers of other hand are placed under the mandible, which is gently lifted upward to move the chin anteriorly. During the chin lift procedure, care must be taken to avoid closing the mouth, pushing on the soft tissues under the chin, or hyperextending the neck since these actions contribute to airway obstruction. The position of the head in infant is neutral (picture 2) and in children is sniffing (picture 3).

Picture 2



Infant – neutral position of the head

Picture 3

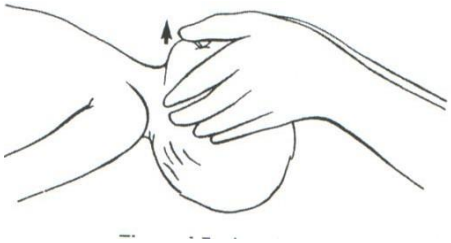


Children – sniffing position of the head

The head-tilt-chin-lift maneuver should **not** be used in children who are suspected of having head or neck injuries.

Jaw thrust — jaw thrust is the preferred method for opening the airway when trauma is suspected, in which case, cervical spine immobilization should also be maintained. The jaw thrust maneuver is performed by grasping the angles of the lower jaw with one hand on each side, and moving the mandible forward so that the lower central incisors are anterior to the upper central incisors (picture 4).

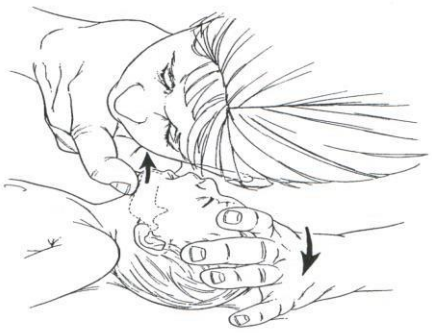
Picture 4



Jaw thrust

The patency of airway should be assessed by placing a face above the child's with ear over the nose, the cheek over the mouth and the eyes looking along the line of the chest for up to 10 sec. **LOOK** for chest movements; **LISTEN** for breath sounds and **FEEL** for exhaled breath (picture 5).

Picture 5



Look, listen, feel

VENTILATION — If the child is not breathing, give 5 rescue breaths. Ventilation can be provided with mouth-to-mouth, mouth-to-nose, or with mouth-to-mouth and nose. Each rescue breath should be delivered over one second. The volume of each breath should be sufficient to see the chest wall rise. For an INFANT rescuer seals a mouth around the victim's mouth and nose (picture 6). For a CHILD rescuer seals a mouth around the victim's mouth

with nose pinched closed using the thumb and index fingers of the hand that is maintaining the head tilt (picture 7).

Picture 6

INFANT - mouth-to-mouth and nose ventilation

Picture 7

CHILDREN - mouth-to-mouth ventilation

CIRCULATION -- Inadequacy of the circulation is recognized by the absence of signs of life. The absence of 'signs of life' is the primary indication to start chest compressions. Signs of life include: movement, coughing or normal breathing.

Signs of poor perfusion include pallor, lack of responsiveness and poor muscle tone.

CHEST COMPRESSIONS—Chest compressions should be performed over the lower half of the sternum. The chest should be depressed at least one-third of its anterior-posterior diameter with each compression, approximately 4 cm in most infants and 5 cm in most children. The optimum rate of compressions is approximately 100-120 per minute. Each compression and decompression phase should be of equal duration.

Infants — Chest compressions for infants (younger than one year) may be performed with

either two fingers or with the two-thumb with encircling hands technique.

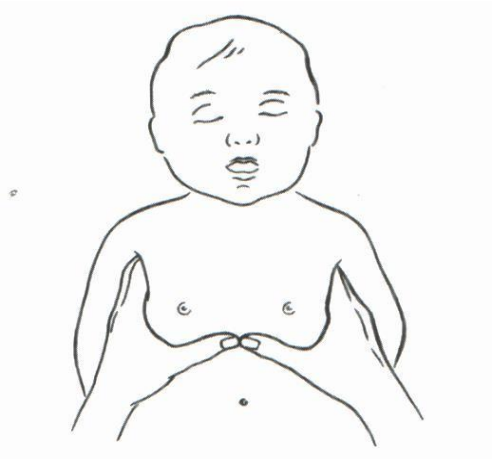
Two-finger — This technique is recommended when there is a single rescuer. Compressions are performed with index and middle finger, placed on the lower half of the sternum, just below the nipples. Because of the infant's large occiput, slight neck extension and the placement of a hand or rolled towel under the shoulders may be necessary (picture 8).

Picture 8

Chest compression – two-finger technique

Two - thumb, encircling hands — The two - thumb, encircling hands technique is suggested when there are two rescuers. The thorax is encircled with both hands and cardiac compressions are performed with the thumbs. The thumbs compress over the lower half of the sternum, just below the nipples, while the fingers are spread around the thorax (picture 9).

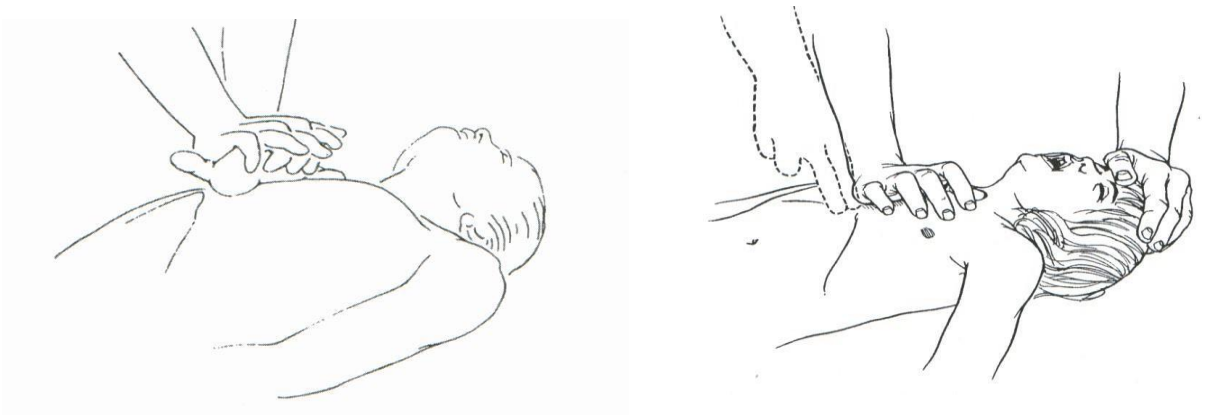
Picture 9



Two-thumb encircling hands technique

Children — For children (from one year until puberty - 18 years), compressions should be performed over the lower half of the sternum with either the heel of one hand or with two hands, as for adult victims (picture 10).

Picture 10



Compression with one or two hands

COMPRESSION TO VENTILATION RATIO — For health care providers, two ventilations should be delivered at the end of every 15th compression. For lay persons two ventilations should be delivered at the end of every 30th compression.

Compressions are delivered at a rate of 100-120 per minute without pauses.

Do not interrupt chest compressions for more than 10 seconds except for defibrillation or/and for emergency call. Compressions can be recommenced at the end of inspiration and may augment exhalation.

Conventional versus compression-only CPR — In some cases if rescuer is unable to ventilate, use compressions-only CPR.I

If there is only one rescuer without mobile phone, after **1 minute of CPR,** the rescuer must call emergency services. In the case of a baby or a small child the rescuer will be able to take the victim to a telephone and continue CPR on the way.

BLS

S.S.S.

Call emergency services

⇩

Airway opening maneuvers

⇩

Look, listen, feel

⇩

5 rescue breaths

⇩

Check for signs of life

(*Take no more than 10 seconds)*

⇩

CPR

15 (30) chest compressions : 2 ventilations

5. NEWBORN RESUSCITATION

Branka Polić, MD

In almost all neonates (90 percent), physiological changes are successfully completed at delivery without requiring any special assistance. However, about 10 percent of neonates will need some intervention, and 1 percent will require extensive resuscitative measures at birth.

The guidelines recommend the following approach.

- Initial steps (provide warmth, clear **A**irway if necessary, dry, and stimulate)
- **B**reathing (ventilation)
- **C**hest compressions
- **D**rugs administration, such as epinephrine and/or volume expansion

A time allocation of 30 seconds is given to apply the resuscitative procedure, evaluate, and decide whether to proceed to the next intervention. Monitoring of oxygen saturation by using pulse oximetry should be performed in neonates who are apneic, gasping, have labored breathing, have persistent cyanosis, or have a heart rate less than 100 beats per minute (bpm). No further resuscitative actions are required if the baby responds with adequate spontaneous respirations and a heart rate above 100 beats per minute.

Provide warmth

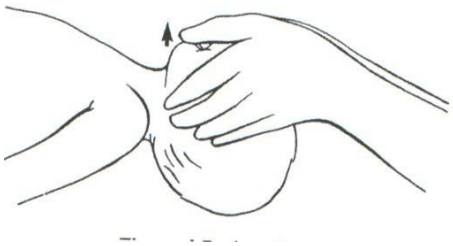
To minimize heat loss, the delivered baby is first placed in a warmed towel or blanket and then under a prewarmed radiant heat source, where he/she is dried with another warmed towel or blanket.

Airway — The baby is positioned to open the airway by placing on his/her back on a flat radiant warmer bed with the neck in a neutral position; the neck should not be hyperextended or flexed. The proper position aligns the posterior pharynx, larynx, and trachea, and facilitates air entry. A rolled blanket or towel may be placed under the baby's shoulder to slightly extend the neck to maintain an open airway (picture 1). Another method is jaw thrust (picture 2).

Picture 1

Neutral position of a head

Picture 2



Jaw thrust

Suctioning immediately after birth is reserved only for babies with obvious obstruction due to secretions, meconium aspiration or depressed vital signs and who require positive pressure ventilation.

Supplemental oxygen - Resuscitation should be initiated with blended oxygen. If blended oxygen is not available, room air should be used.

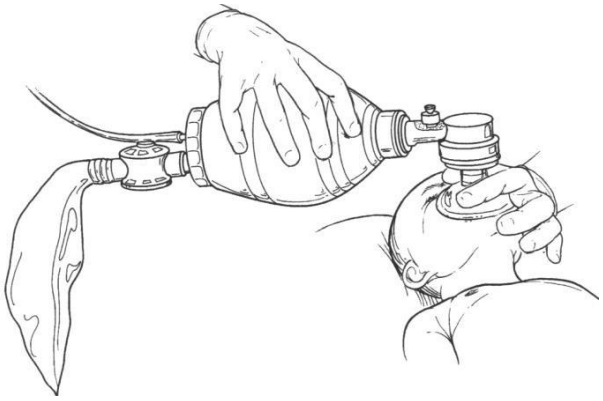
- The oxygen concentration should be adjusted to achieve targeted SpO_2 levels, which are monitored by pulse oximetry.

Breathing – If the baby is not breathing, give five initial breaths and look for chest movements.

The initial administered breaths often require pressures of 30 to 40 cm H_2O to inflate the lungs of the newly-born term neonate. In most preterm neonates, an initial inflation pressure of 20 to 25 cm H_2O is usually adequate. Adequacy of ventilation is demonstrated by improvement in heart rate. Chest wall movement should be assessed if heart rate does not improve. The neonate should be ventilated at a rate of 40 to 60 times per minute to achieve a heart rate >100 bpm.

Ventilation is achieved with a bag and mask and addition of oxygen if it is necessary. An airtight seal between the rim of the mask and the face is essential to achieve the positive pressure required to inflate the lungs. An appropriately sized mask is selected and positioned to cover the chin, mouth, and nose, but not the eyes of the infant. The mask is held on the face by positioning the hand of the clinician so that the little, ring, and middle fingers are spread over the mandible in the configuration of the letter "E" and the thumb and index are placed over the mask in the shape of the letter "C". The ring and fifth fingers a sligtly lift the chin forward to maintain a patent airway. With the other hand squeeze the bag in order to achieve ventilation (picture 3).

Picture 3



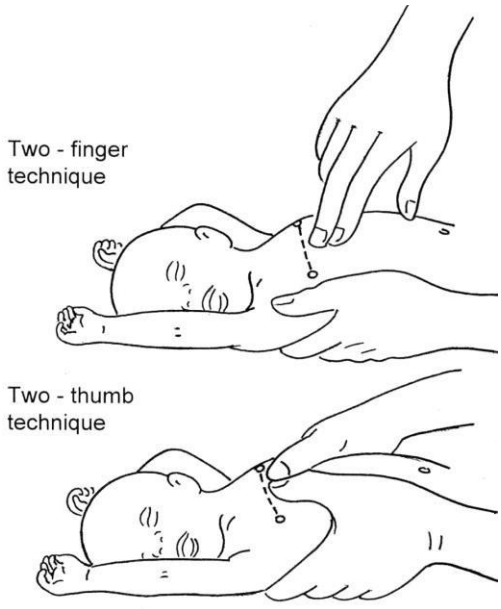
Bag-mask ventilation

Chest compressions — Chest compressions are initiated if the neonate's heart rate remains <60 beats per minute despite adequate ventilation for 30 seconds. In newborns heart rate is not to be palpated but is auscultated with stethoscope at the apex of the heart.

Chest compression applies pressure to the lower third of the sternum, visualized as an imaginary line just below the nipples. Two methods are used to deliver neonatal chest compressions.

- Two - thumb technique – In this method, both hands encircle the neonate's chest with the thumbs on the sternum and the fingers under the neonate. This is the preferred method.
- Two-finger technique – In this method, the tips of the first two fingers, or the index and middle finger, are placed in a perpendicular position over the sternum (picture 4).

Picture 4



Two chest compression techniques

In both methods, pressure is applied to the chest wall sufficiently to depress the sternum about one-third of the anteroposterior diameter of the chest, and then pressure is released to allow the heart to refill.

Chest compressions must always be accompanied by positive pressure ventilation. During neonatal resuscitation, the chest compression rate is 90 per minute accompanied by 30 ventilations per minute, with one ventilation interposed after every third compression.

After 30 seconds of chest compression and positive pressure ventilation, reassessment of the neonate's heart rate, color, and respiratory rate should determine whether further interventions are required (intubation or administration of medications).

Drugs — Drugs are rarely required in neonatal resuscitation. Delivering adequate ventilation is the most important resuscitative step because the most common cause of bradycardia is inadequate lung inflation or profound hypoxemia. If the heart rate remains <60 beats per minute despite adequate ventilation and chest compressions, administration of epinephrine is indicated through umbilical vein catheter.

Resuscitation Council UK

GUIDELINES 2021

Newborn life support

(Antenatal counselling)
Team briefing and equipment check

Birth
Delay cord clamping if possible

Start clock / note time
Dry / wrap, stimulate, keep warm

Assess
Colour, tone, breathing, heart rate

Ensure an open airway
Preterm: consider CPAP

If gasping / not breathing
- **Give 5 inflations (30 cm H_2O) – start in air**
- Apply PEEP 5–6 cm H_2O, if possible
- Apply SpO_2 +/- ECG

Reassess
If no increase in heart rate, look for chest movement

If the chest is not moving
- Check mask, head and jaw position
- 2 person support
- Consider suction, laryngeal mask/tracheal tube
- Repeat inflation breaths
- Consider increasing the inflation pressure

Reassess
If no increase in heart rate, look for chest movement

Once chest is moving continue ventilation breaths

If heart rate is not detectable or < 60 min^{-1} after 30 seconds of ventilation
- Synchronise 3 chest compressions to 1 ventilation
- Increase oxygen to 100%
- Consider intubation if not already done or laryngeal mask if not possible

Reassess heart rate and chest movement every 30 seconds

If the heart rate remains not detectable or < 60 min^{-1}
- **Vascular access and drugs**
- Consider other factors e.g. pneumothorax, hypovolaemia, congenital abormality

Update parents and debrief team
Complete records

Preterm < 32 weeks

Place undried in plastic wrap + radiant heat

Inspired oxygen
28–31 weeks 21–30%
< 28 weeks 30%

If giving inflations, start with 25 cm H_2O

Acceptable pre-ductal SpO_2	
2 min	60%
5 min	85%
10 min	90%

TITRATE OXYGEN TO ACHIEVE TARGET SATURATIONS

APPROX 60 SECONDS

MAINTAIN TEMPERATURE

AT ALL TIMES ASK **"IS HELP NEEDED"**