Hypothermia in newborn

Slide NH-l

Newborn baby is a homoeothermic, but his ability to stay warm may easily be overwhelmed by extremes of environmental temperatures. Neonatal hypothermia often due to lack of attention by health care providers continues to be a very important cause of neonatal deaths.

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A newborn is more prone to develop hypothermia because of large surface area per unit of body weight. A low birth weight baby has decreased thermal insulation due to less subcutaneous fat and reduced amount of brown fat. Brown fat is the site of heat production. It is localized around the adrenal glands, kidneys, nape of neck, inter scapular area and axillary region. Metabolism of brown fat results in heat production. Blood flowing through the brown fat becomes warm and through circulation transfers heat to other parts of the body. This mechanism of heat production is called **non-shivering thermogenesis.**

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Thermal balance

Newborn loses heat by *evaporation* particularly soon after birth (due to evaporation of amniotic fluid from skin surface), *conduction* (by coming in contact with cold objects-cloth, tray etc.), *convection* (by air currents in which cold air replaces warm air around baby-open windows, fans) and *radiation* (to colder solid objects in vicinity-walls). The process of heat gain is by conduction, convection and radiation in addition to non-shivering thermogenesis.

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Thermo neutral environment

The temperature range during which the basal metabolic rate of the baby is at a minimum, oxygen utilization is least and baby thrives well is known as 'Thermo- neutral range of temperature' or 'Neutral Thermal Environment'. For each baby, this range of temperature varies depending on gestational age.

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Definition

Normal axillary temperature is 36.5-37.5°C.

In hypothermia the temperature is below 36.5 degree centigrade.

Cold stress 36.0°C to 36.4°C

Moderate hypothermia 32.0°C to 35.9°C

Severe hypothermia <32°C

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Temperature recording

Preferably a low reading thermometer which can record temperature as low as 30°C should be used in the newborn .

(a) Axillary temperature is as good as rectal and probably safer (less risk of injury or infection). It is recorded by placing the bulb of thermometer against the roof of dry axilla, free from moisture. Baby's arm is held close to the body to keep thermometer in place. The temperature is read after three minutes.

(b) Rectal temperature: Do not use this method for routine monitoring. However, it is the best guide *for core temperature in cold* (hypothermic) sick neonates. It is recorded by inserting the greased bulb of the thermometer backwards and downwards to a depth of 3 cm in a term baby (2 cm in a preterm baby). Keep thermometer in place at least for 2 minutes.

Rectal temperature is not recorded as a standard procedure in neonate. Record rectal temperature only for sick hypothermic neonates.

(c) Skin temperature: Skin temperature is recorded by a thermister. The probe of the thermister is attached to the skin over upper abdomen. The thermister senses the skin temperature and displays it on the panel.

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Human touch

Baby's temperature can be assessed with reasonable precision by human touch, the reliability of which can be enhanced by training. Abdominal temperature is representative of the core temperature and it is reliable in the diagnosis of hypothermia.

The warm and pink feet of the baby indicate that the baby is in thermal comfort. But when feet are cold and trunk is warm it indicates that the baby is in cold stress. In hypothermia both feet and trunk are cold to touch.

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The concept of "Warm Chain"

Baby must be kept warm at the place of birth (home or hospital) and during transportation for special care either from home to hospital or within the hospital.

Satisfactory control demands both prevention of heat loss and promotion of heat gain. The "warm chain" is a set of ten interlinked procedures carried out at birth and later, which will minimize the likelihood of hypothermia in all newborns.

1. Warm delivery room (> 25°C)
2. Warm resuscitation
3. Immediate drying
4. Skin-to-skin contact between baby and the mother
5. Breastfeeding
6. Bathing and weighing postponed

7. Appropriate clothing and bedding
8. Mother and baby together
9. Warm transportation
10. Training/awareness of healthcare providers

Slide NH-1O

Prevention of hypothermia

1. In the delivery room

- Conduct delivery in a warm room
- Immediately dry newborn with a clean soft preferably warm towel .Use another warm towel to wrap the baby in two layers
- Ensure head is well covered
- Keep the baby by the side of the mother (mothers' temperature will keep the baby warm)

Bathing of babies at birth is a dangerous practice and should be avoided.

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2. Skin-to-skin contact (The Kangaroo Method)

"Kangarooing"

(a) Assists in maintaining the temperature of infant

(b) Facilitates breastfeeding

(d) Helps to increase the duration of breastfeeding

(e) Improves mother infant bonding

A baby who is born LBW (less than 2500 g) often needs special care in a hospital. If there are no signs of distress or extreme prematurity, a mother can provide warm environment by "Kangarooing" the baby at home or hospital.

- Place the baby naked, with or without a nappy, upright inside mothers clothing against the bare skin over the chest. (A loose blouse, sweater or wrap tied at the waist holds the baby)
- Let baby suckle at breasts as often as he wants, but at least every 2 hourly. Mother should sleep propped up so that the baby stays upright
- Make sure the baby stays warm at all times.

- If environmental temperature is low, dress the baby with extra clothing and cover his head.
- When mother wants to bathe or rest, ask the father or another family member to 'Kangaroo' the baby or wrap infant in several layers of warm clothing, covered with blankets and keep in a warm place.
- Take baby for regular check ups for vaccination and weight record.

For more details refer to chapter on Kangaroo mother care

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3. Bathing the baby

Bathing should be avoided immediately after birth. Ensure before giving bath that temperature is normal. Preferably, give bath to normal baby on second day in summer. In winter bathing may be avoided for several days. *Postpone bath till next day in term baby ; no bath to babies who are sick / admitted in nursery ; Small &/or LBW baby- postpone till cord falls or preferably till weight is 2.5 kg .*

The nurse or attendant should follow the instructions for bathing as given below.

- Use warm room and warm water.
- Bathe quickly and gently.
- Dry quickly and thoroughly from head to toe.
- Wrap in a warm, dry towel.
- Dress and wrap infant, use a cap on the head.
- Place infant close to mother.

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4. Cot-nursing in hospital (mother sick)

- Adequately clothe the baby (including head, extremities)
- Keep ambient atmospheric temperature warm for baby's weight and postnatal age (28-32°C)
- Monitor body temperature frequently at least 3 hourly during the initial postnatal days.

In cold weather wrap the baby well but in hot weather (or when baby has fever) use loose clothes.

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5. Temperature maintenance during transport (weakest link in warm chain)

- Always stabilize the baby's temperature before transport.
- Record temperature before transport and take remedial measures. If temperature cannot be documented, use touch to judge temperature. Hands and feet should be as warm as abdomen.
- Carry the baby close to the chest of mother
- Cover head, legs and hands. Avoid undressing the infant for cleaning, weighing or examination. Postpone these until baby is warm.
- Thermocol box with pre warmed linen or plastic bubble sheet or silver swaddler may be used during transport.
- Water filled mattress with thermostat to control temperature may be used for transport ,if available.

For more details refer to chapter on transport of sick newborn

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Signs and symptoms of hypothermia

(a) Peripheral vasoconstriction
- -Acrocyanosis
- -Cool extremities
- -Decreased peripheral perfusion

(b) CNS depression
- -Lethargy
- -Bradycardia
- -Apnea
- -Poor feeding

(c) Increased metabolism
- -Hypoglycemia
- -Hypoxia
- -Metabolic acidosis

(d) Increase of pulmonary artery pressure
- -Distress
- -Tachypnea

(e) Chronic signs

-Weight loss, poor weight gain

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Management of hypothermia

At Health centre/FRU/Hospital confirm the diagnosis of hypothermia by recording actual body temperature. A hypothermic baby has to be rewarmed as quickly as possible. The method selected will depend on the severity of hypothermia and availability of staff and equipment.

The methods to use include

- Skin-to-skin contact
- a warm room or bed
- a 200 watt bulb
- a radiant heater or an incubator

Infection should be suspected if hypothermia persists despite above measures.

Monitor axillary temperature every ½ hour till it reaches 36.5 °C, then hourly for next 4 hours, 2 hourly for 12 hours thereafter and 3 hourly as a routine.

Moderate hypothermia (>32 to ≤ 36°C)

Skin-to-skin contact should be in a warm room and warm bed. Warmer / incubator may be used, if available. Continue rewarming till temperature reaches normal range. Monitor every 15-30 minutes.

Severe hypothermia (<32°C)

Use air heated incubator (air temp 35-36°C) or manually operated radiant warmer or thermostatically controlled heated mattress set at 37 -38°C. Once baby's temperature reaches 34°C the rewarming process should be slowed down. Alternately, one may use room heater or 200 watts bulb or infrared bulb. Monitor B.P., HR, temperature and glucose (if facilities are available).

In addition

- take measures to reduce heat loss
- start IV 10% Dextrose @ 60-80 ml/kg/day
- give Inj Vit K 1 mg for term; 0.5 mg in preterm
- provide oxygen

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Hyperthermia

Fever (temperature above 37. 5°C) is a sign of infection usually in term neonate. In all febrile neonates, a diligent search for a possible infective focus must be made. In summer months, hyperthermia may occur due to raised environmental temperature. This may be treated by moving the baby into cool environment and using loose light clothes for the baby. When the temperature is 37.5°C-39°C, undressing and exposing the neonate to room temperature is usually all that is necessary. If the temperature is above 39°C, the neonate should be undressed and sponged with tepid water at approximately 35°C until the temperature is below 38°C.Many times in nursery overheating under warmer is the cause rather than infection.

Do not use cold/ice water for sponge. Tap water is enough

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Conclusion

In conclusion, maintaining a normothermic state in a newborn is an essential basic need in the early days of life. All efforts must be made to maintain the warm chain, detect hypothermia early and take prompt remedial measures to correct it. Specially LBW and at risk baby need close monitoring and stricter preventive measures. This will significantly reduce the morbidity and mortality in the newborn period.

For further reading

The information in this article is based on extensive clinical experience and reading of availasble literature. This listing contains some of the work that has been most useful.

(1) Thermal control of the newborn: a practical guide. WHO/FHE/MSM/93.2.

(2) Thermal protection of the newborn: a practical guide. WHO/RHT /MSM/97 .2.

(3) Guidelines for perinatal care. Second edition, American Academy of Pediatrics and American College of Obstetricians and Gynecologists, 1988.

(4) Essential newborn nursing for small hospital in resource restricted countries: Learner's guide. Publication of Department of Pediatrics WHO-CC, New Delhi, 2004.