PERINATAL ASPHYXIA
Gas exchange.
Why do some babies need help with breathing at birth?

Something is wrong with the ‘drive to breath’

- ASPHYXIA (Intrapartum asphyxia)
  - Prematurity
  - Sepsis
  - Drugs administered to mother (GA)
  - Congenital malformation, intracranial disease

Too weak - Neuromuscular disease
Burden of DEATH from asphyxiation

- STILLBIRTHS PLUS
  - Number less certain
  - ~4 000 000
  - ~1 000 000 from asphyxiation
    - Antenatal
    - Intrapartum

- NEONATAL DEATHS
  - 4 000 000 / year
  - ~1 000 000 intrapartum asphyxiation

Figure 4: Estimated distribution of direct causes of 4 million neonatal deaths for the year 2000. Based on vital registration data for 45 countries and modelled estimates for 147 countries.
Perinatal Asphyxia

Definition

Condition in the foetus/newborn where there is reduced $O_2$ saturation (hypoxaemia) and increased acid in the blood (acidaemia) from carbon dioxide retention and lactic acid accumulation.
Causes/ Predisposing factors

50 – 70% of babies who would require assistance may be predicted

Maternal (prenatal) factors

✓ Infections - amnionitis etc
✓ Lungs - pneumonia, asthmatic attack etc
✓ Cardiac - arrythmias, heart failure etc
✓ Vascular - anæmia (haemoglobinopathy, Nutritional, Leukaemias, Diabetes, Hypertension, CKD)
Causes/ Predisposing factors

- Uterus - hypertonia, malformations, rupture.
- Others - drugs; narcotics, anaesthetics, alcohol, magnesium sulphate, tranquillizers.
- Prolonged obstructed labour.

Placental problems

- Abruptio, placenta previa, placenta insufficiency.

Foetal factors

- Prematurity, postmaturity,
- Developmental anomalies eg. Diaphragmatic hernia, pulmonary hypoplasia, choanal atresia.
- Cord problems eg knotting, compression, prolapse
- Infections eg congenital pneumonia
Assessment of baby

Anticipation is the key to good care – adequate preparation

- Maternal and foetal monitoring before and during labour is essential.
- FHR, Foetal scalp blood pH and use of cardiotocograph to monitor variability in FHR.
- At delivery, assess colour, heart rate and respirations, pulse oximetry
  
  **Apgar Score**

- Assessed at 1min, 5min and may be extended till scores are > 6
- Typically reflects adequacy of or response to resuscitation
# Apgar score

<table>
<thead>
<tr>
<th>Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Pale Or Centrally Cyanosed</td>
<td>Peripheral Cyanosis</td>
<td>Completely Pink</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>Absent</td>
<td>&lt;100b/Min</td>
<td>&gt;100b/Min</td>
</tr>
<tr>
<td>Reflex Irritability</td>
<td>Non</td>
<td>Grimace</td>
<td>Cry</td>
</tr>
<tr>
<td>Muscle Tone</td>
<td>Flaccid</td>
<td>Some Flexion</td>
<td>Well Flexed</td>
</tr>
<tr>
<td>Respiration</td>
<td>Absent</td>
<td>Weak, Irregular</td>
<td>Regular</td>
</tr>
</tbody>
</table>
Apgar score con’t

- Score $\geq 7$ - well

- 1 – 3@ 1min or $\leq 5 @ 5$ min is severe asphyxia and risk of sequelae is high

- Delayed onset of spontaneous respiration

- Clinical signs of encephalopathy even with acceptable scores

- Score of 5 or less $@ 10$ mins predicts death or major neurologic disability
Physiology of Asphyxia

- Chronic partial
  - Recurrent episodes of partial asphyxia due to declining placenta function with post maturity, abnormalities of uterine contractions, cord entanglements.
- BP increases initially
- Bradycardia
- CO concentrated on placenta, brain and myocardium
- PaO$_2$ drops
- Lactic acid accumulates
- PaCO$_2$ rises

Respiratory & metabolic acidaemia
Physiology of Asphyxia

- Foetus usually recovers (clinical & biochemical) between episodes if transient and infrequent

- If baby is born during such episodes, may be apnoeic but responds promptly to resuscitation
  - May have few or no sequelae.

- Prolonged episodes (about 1hr) or foetus does not recover between episodes, there is;
  - Hypotension & profound acidaemia
  - Multiorgan damage including the brain
  - Usually require prolonged resuscitation/have delayed onset of spontaneous respiration
  - Severe neonatal illness/ permanent sequelae even with prompt resuscitation
Physiology of Asphyxia

Acute Asphyxia
Rare

1° Apnea
- Respirations cease
- Heart rate decreases
- Blood pressure decreases
- No response to stimulation
- The whole process may take up to 20mins
Effects of severe asphyxia

CNS

Cerebral oedema, SIADH, ICH, resulting in seizures, hypotonia, mental retardation, learning disabilities, speech disorders, cerebral palsy – spastic quadriplegia or dyskinetic syndromes.

Resp

- respiratory distress, type II RDS, persistent pulmonary hypertension.

CVS

- left ventricular dysfunction, tricuspid incompetence, PDA, cardiogenic shock, hypoxic cardiomyopathy

Renal

- bladder atony, acute tubular necrosis, acute cortical necrosis, myoglobinuria.
Effects of severe asphyxia

GIT
- dysmotility, increased risk of NEC, liver dysfunction.

Haemopoietic
- marrow suppression, DIC, increased risk of infection.

Metabolic
- hypo or hyperglycaemia, hyponatraemia, hypocalcaemia, acidosis.

  adrenal hemorrhage and necrosis
Can we impact on the burden of asphyxia (STILLBIRTH, NND, DISABILITY) and, if so, how?

- There are 3 possible intervention points.

  - **PRIMARY INTERVENTION** – prevention of asphyxia
    - Maternal health and reproductive health
    - Health facility birth
    - Risk factor identification (intrapartum)
    - Early obstetric intervention (referral services etc)
      - Recognise and manage complications

  - **SECONDARY INTERVENTION** – neonatal resuscitation

  - **TERTIARY PREVENTION**
    - Care of neonatal encephalopathy - NICU (referral services)
Preparation for Resuscitation

- Preparation for a high risk delivery is often the key to a successful outcome.
- Cooperation between the obstetrician & paediatrician.
- Knowledge of the risk factor & appropriate intervention is essential.
- Estimate the gestational age & weight.
- Get the supplies and equipment for resuscitation ready.
Suction equipment
- Functioning Mechanical suction and tubing
- Suction catheters, 5F for sucking through endotracheal tube, 6F for preterm, 8F & 10F for term and 12F to suck meconium
- Feeding tube and 5-mL syringe
- Meconium aspiration device
- Oxygen cylinders
- Neonatal resuscitation bag Face masks, term and premature sizes
**Intubation equipment**

- Laryngoscope with straight blades, No. 0 (preterm) and No. 1 (term)
- Extra bulbs and batteries for laryngoscope
- Tracheal tubes, 2.5, 3.0, 3.5, and 4.0 mm ID, (for the dept use 6+patient weight/Kg)
- Stylet (optional)
- Scissors
- Tape or securing device for tracheal tube
Size of endotrachea tube for gestational age/weight

<table>
<thead>
<tr>
<th>Weight (grams)</th>
<th>Gestational age, (weeks)</th>
<th>Endotracheal tube size, inside diameter (mm)</th>
<th>Depth of insertion (cm from upper lip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1000</td>
<td>28</td>
<td>2.5</td>
<td>6-7</td>
</tr>
<tr>
<td>1000-2000</td>
<td>28-34</td>
<td>3.0</td>
<td>7-8</td>
</tr>
<tr>
<td>2000-3000</td>
<td>34-38</td>
<td>3.5</td>
<td>8-9</td>
</tr>
<tr>
<td>3000</td>
<td>38</td>
<td>3.5-4.0</td>
<td>9-10</td>
</tr>
</tbody>
</table>
Neonatal Resuscitation Supplies and Equipment

- **Medications**
  - Epinephrine 1:10 000 (0.1 - 0.3mL/kg/dose)
  - Isotonic crystalloid (normal saline or Ringer's lactate) for volume expansion

- Sodium bicarbonate 8.4%
### Neonatal Resuscitation Supplies and Equipment

<table>
<thead>
<tr>
<th>Other equipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Radiant warmer or other heat source</td>
</tr>
<tr>
<td>☑ Firm, padded resuscitation surface</td>
</tr>
<tr>
<td>☑ Clock (timer)</td>
</tr>
<tr>
<td>☑ Warmed linens</td>
</tr>
<tr>
<td>☑ Umbilical catheters, 3.5F, 5F</td>
</tr>
</tbody>
</table>

<p>| |</p>
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<tbody>
<tr>
<td>☑ Stethoscope</td>
</tr>
<tr>
<td>☑ pulse oximeter with probe or Cardiac monitor and electrodes</td>
</tr>
<tr>
<td>☑ Oropharyngeal airways</td>
</tr>
</tbody>
</table>
Algorithm for resuscitation of the newly born infant.

Approximate time

Birth

- Clear of meconium?
- Breathing or crying?
- Good muscle tone?
- Color pink?
- Term gestation?

No

- Provide warmth
- Position, clear airway* (as necessary)
- Dry, stimulate, reposition
- Give O₂ (as necessary)

Evaluate respirations, heart rate, and color

Breathing

- HR >100 and pink
  Supportive care

Apnea or HR <100

- Provide positive-pressure ventilation*

Ventilating

- HR >100 and pink
  Ongoing care

HR <60

- Provide positive-pressure ventilation*
- Administer chest compressions

HR >60

- Administer epinephrine*

HR <60

*Endotracheal intubation may be considered at several steps.
Diagnosis

Documentation.

- Apgar score and how derived
- Time to sustained spontaneous respiration.
- Nature of resuscitation
Diagnosis

Documentation.

- Duration of resuscitation
- Time of transfer to newborn unit.
- Neurological status (grading of NE).
Initial management

- Admit in newborn unit babies with Apgar score of \( \leq 3 \) @ 1 min or \( \leq 5 \) @ 5 min.
- NPO, I.V fluid 10% D/W @ 40-60 ml/kg /d for term, 60-80 ml/kg /d for preterm.
- IM Vit K, preterm 0.5mg, term 1mg stat.
- Intranasal \( \text{O}_2 \) 2-4L/min if in respiratory distress.
SUMMARY OF INITIAL MANAGEMENT

Initial management

- Pulse oximetry ($\text{SaO}_2$, normal range 95-100%) 2hrly
- Check haematocrit.
- Gastric lavage until clear
- Strict I/O chart
- Minimal handling
SUMMARY OF INITIAL MANAGEMENT

Biochemical monitoring

- If the baby is hypoglycemic, a bolus of 2 ml/kg of 10% dextrose and continue to maintain at 6 to 8 mg/kg/minute

- RBG ¼ hrly *4, 1/2hrly *4 then hrly until euglycemic (70-100mg/dl)
Clinical monitoring

- Maintenance of rectal temp @ >36.5-37.5 °C.
- Avoid hyperthermia
- Monitor BP, HR, RR, capillary refill time (CFT<3 seconds)
- Monitor Central Venous Pressure (Term5-8—Preterm, 3-5cmH2O.)
- Monitor urine output on hourly basis normal range 1-3ml/kg/hr,
- Urine SG 12hrly.(1.006-1.012).
SUMMARY OF INITIAL MANAGEMENT

Clinical monitoring cont

- If oliguric (0.6ml/kg/hr), anuric (1ml/kg /d), exam for bladder, if distended, apply gentle suprapubic pressure otherwise catheterize. If no urine give fluid challenge.

- Give normal saline if in shock@ 10-15ml/kg or ringer lactate over 20-30mins. If no response after 30min to 1hr repeat above ensure no features of fluid overload: edema, respiratory distress or abnormal weight gain.

- If no response to fluid challenge restrict fluid and give diuretic IV laxis @ 1mg/kg stat.
SUMMARY OF INITIAL MANAGEMENT

Clinical monitoring cont

- Avoid fluid overload.
- Monitor weight – there should be no weight gain in the first week except in SGA infants.
- Wt gain may indicate fluid retention from SIADH or ARF
- Monitor anterior fontanel, tone, seizures, pupillary size & reaction every 12 hrly
- Assessment of the neurologic status should include Sarnat & Sarnat staging
Biochemical monitoring

- E and U on day 1 and at least day 3, earlier if deranged
- If there is SIADH. (hyponatremia <125mmol/l and urine SG >1.012, and normal renal function)
- Restriction fluid to the volume that will supply 2-3mmol/kg/d of Na using 3% N/S or N/S if 3% saline NA.
- Monitor ABG,
SUMMARY OF INITIAL MANAGEMENT

Clinical monitoring cont

- Abdominal girth 12hrly.
- Lookout for seizures, if present give IV phenobarbitone 20mg /kg (1 mg/kg/min) stat
- If no response repeat 5mg /kg /dose every 30 min up to a max dose of 40mg/kg (if >20mg/kg is required, ventilator support is mandatory). or repeat 20mg/kg after 6hr, follow up with maintenance dose of 5 mg/kg/day
- Monitor level of consciousness at least 6 hourly
- If there is raised ICP with symptoms; seizures, apnoea, anisocoria, bulging fontanel. - Give IV mannitol, 20%, 0.5-1g/kg/dose 6hrly
INVESTIGATIONS

- PCV
- RBG
- E&U, Cr
- pulse oximetry
- Urine SG 12hrly
- Urinalysis
INVESTIGATIONS

- FBC
- Blood culture
- CXR if there is respiratory distress
- Monitor OFC twice weekly.
- TFUSS
- CT - aEEG
Neurological examination (sanart & sanart staging of NE)

<table>
<thead>
<tr>
<th>Grade 1:</th>
<th>Infant hyperalert, irritable, and over-sensitive to stimulation. Sympathetic over-stimulation with tachycardia, dilated pupils and jitteriness. The EEG is normal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 2:</td>
<td>Lethargy, hypotonia and proximal weakness. Parasympathetic overstimulation with low resting heart rate, small pupils, and copious secretions. EEG is abnormal and 70% of infants will have seizures</td>
</tr>
<tr>
<td>Grade 3:</td>
<td>Stupor us, flaccid infant, and absent reflexes. Seizures EEG with decreased background activity and/or voltage suppression</td>
</tr>
</tbody>
</table>
Sarnat

- **Outcome**
  - **Mild:** About 100% normal
  - **Moderate:** 80% normal; abnormal if symptoms more than 5 to 7 days
  - **Severe:** About 50% die; remainder with severe sequel
Thank You