The Golden Hour

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UMKC School of Medicine

BEST CHILDREN'S HOSPITALS U.S.News & WORLD REPORT RANKED IN 10 SPECIALTIES 2018-19

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

What is the Golden Hour?

Refers to the initiation of treatment in a systematic, efficient manner in an effort to rapidly stabilize the neonate

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Why is the Golden Hour worth discussing?

- First hour of life is a time of profound and critical adaption for any baby
- Infant's risk of mortality is at its highest immediately after birth
- Studies suggest that management during this time period can have a significant impact on long term outcomes

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According to the Joint Commission, ineffective communication is a root cause for what percentage of all sentinel events reported?

- A. 25%
- B. 33%
- C. 66%
- D. 75%

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Teamwork/Communication

- Effective communication is as important in a resuscitation as knowing what dose of a medication to give
- Stabilization at birth is associated with multiple considerations that occur both simultaneously and in sequence
- Its chaotic…we have the opportunity to turn this chaos into “ordered chaos”

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Teamwork/Communication

- Checklists
- Briefing and debriefing

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The Golden Hour

Thermoregulation

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Thermoregulation

- At birth, heat is lost rapidly. Core body temperature can drop by 2-3 degrees C in the first 30 minutes of life
- Heat loss is even greater the more preterm a baby is
- Extra care should be taken to prevent hypothermia, one person should be assigned to monitor and intervene in the delivery room.

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Thermoregulation

- Why are preterm infants or VLBW babies more at risk?
  - Larger surface area to body mass ratio, weak muscle tone/flexion, thinner immature skin, increased evaporative water loss, poor ability to vasoconstrict in first few days of life, reduced amounts or no brown fat
- Mechanism to compensate for this heat loss requires energy, which increases the calorie consumption and increases their metabolic demands which can have detrimental effects

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Thermoregulation

Mechanisms of Heat Loss:

1. Evaporation
2. Conduction
3. Radiation
4. Convection

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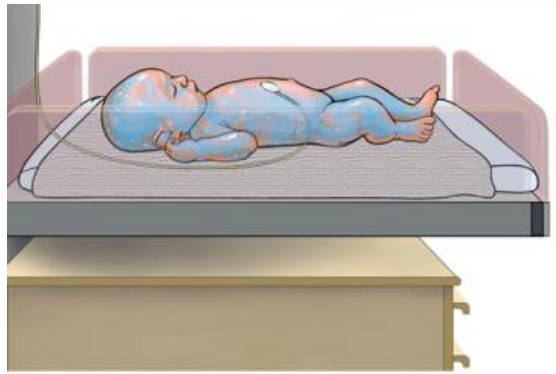
Evaporation

- Major source of heat loss in the premature infant, especially after delivery
- Continues even after infant is dry in low humidity environment
- Can lose as much as 15 times more water per kg than term infants
- How to prevent?
  - Dry infant and/or place in plastic wrap
  - Keep wet linens away from infant
  - Double walled incubators with at least 60% humidity added



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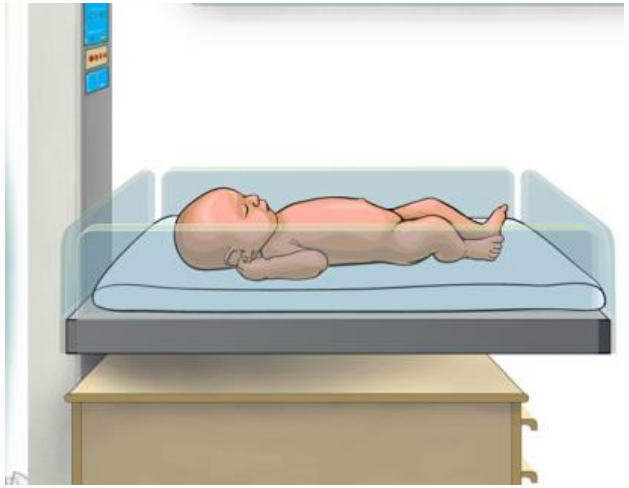
Conduction

- Transfer of heat between 2 solid objects that are in contact with each other
- Radiant warmer, scale, xray
- Rate of heat loss is proportional to the temperature differential between infant and object
- How to prevent:
  - Prewarm all equipment, towels, blankets

    Scales, sterile fields, pre-warm fluids, use

    chemical mattress



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Radiation

- Heat lost via radiation of infrared energy from nearby cold surfaces, such as wall or window
- Cooler object will absorb heat from the neonate even if they are not in direct contact
- Rate of loss proportional to temperature differential between infant and object
- How to prevent?
  - Use double walled incubators, warm

    Environmental surfaces

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Convection

- Occur when infant is in contact with moving air or water that is cooler than body temperature.
- Proportional to temperature differential between air/fluid and infant.
- Infant can lose heat to the air very rapidly in cooler rooms (when moving from mom to the warmer, etc)
- How to prevent?
  - Control air flow in the room, minimize opening and closing of doors, cover infant with warm towels when moving infant, provide warmed humidified air, keep portholes closed

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Physiologic effects of hypothermia

Remember:

1. **Hypothermia in infants is an independent risk factor for morbidity and mortality**
2. **For every degree below 36 C on admission temperature, mortality increases by 28%**

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Physiologic effects of hypothermia

1. Hypoxia
    - Increased oxygen need for thermogenesis which can lead to hypoxia, results in increased resp distress and increased oxygen requirements, desaturations
    - Can lead to anaerobic metabolism and pulmonary vasoconstriction
    - Can lead to surfactant inactivation, pulmonary hemorrhage, and resp failure
    - Twice as much oxygen is needed when an infant's temperature is 35 C vs 37 C

Physiologic effects of hypothermia

2. Hypoglycemia

- Increased metabolic demand to produce heat
- Poorly timed increased glucose need- stores are diminished and may have a delay in glucose delivery depending on vascular access

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Physiologic effects of hypothermia

3. Respiratory and Metabolic acidosis

- Anaerobic metabolism and continued hypoxia can lead to lactic acidosis which can compromise cardiac output and worsen the acid/base balance

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Physiologic effects of hypothermia

4. Cardiovascular compromise

- Bradycardia, hypotension, decreased perfusion
- Can lead to impaired contractility and function

5. Neurologic compromise

- Increase permeability of the blood-brain barrier
- Could increase risk for IVH, with alteration in SVC flow and hypoperfusion

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What temperature should the delivery room be for a 24 weeker?

a. 72

b. 75

c. 80

d. 78

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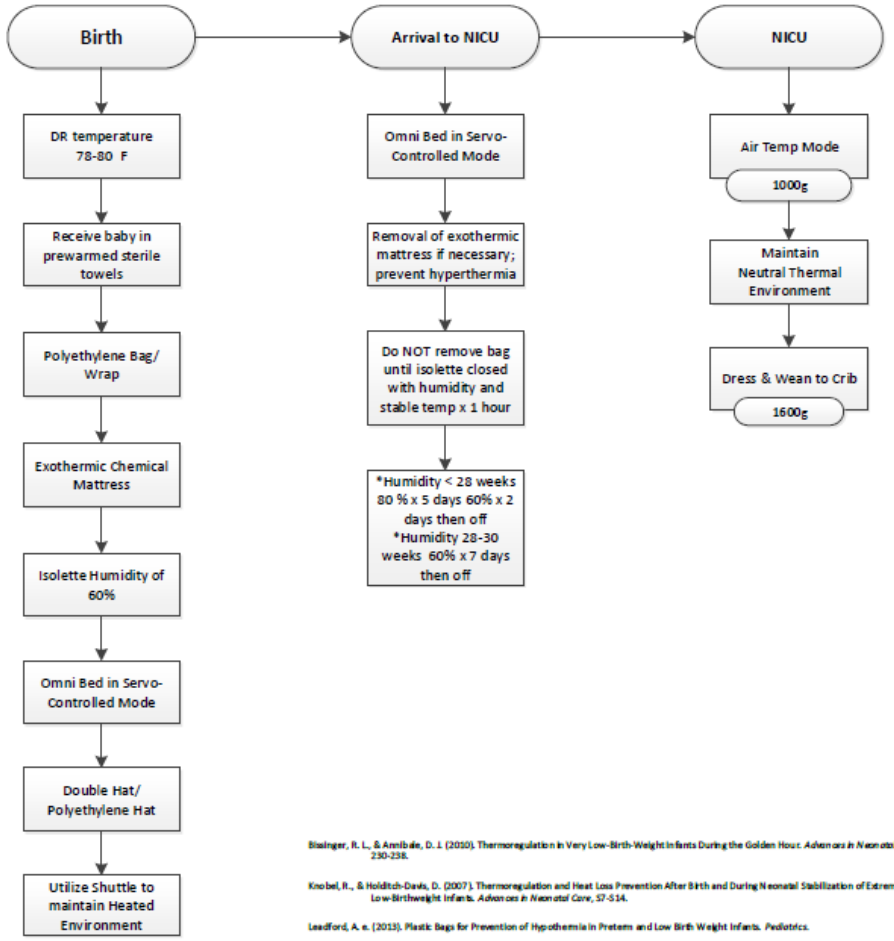
Thermoregulation in Preterm Infants < 30 weeks Gestation



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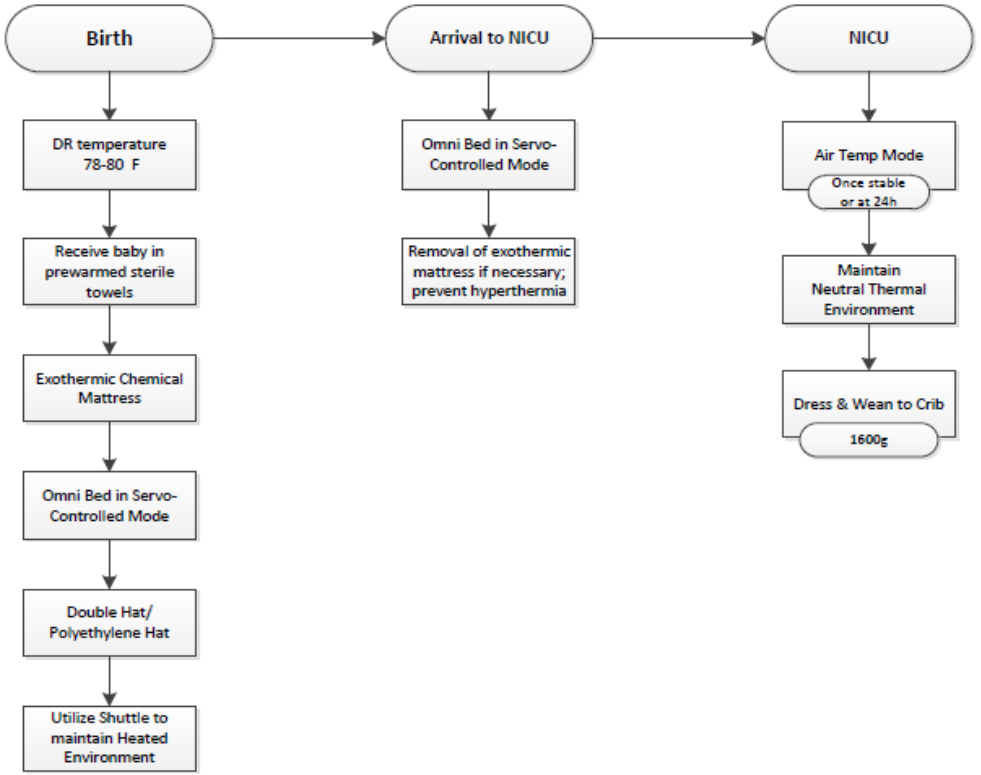
Thermoregulation in Preterm Infants 30-33 Weeks Gestation



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Golden Hour(s): Respiratory

Respiratory

- In first hour after birth infant is completing transition from fetal physiology to neonatal physiology
- Accelerated by crying
- Preterm neonate is less capable of normal transition, often need some degree of respiratory support
  - Structurally immature lungs, surfactant deficient, fluid filled, not supported by rigid chest wall, often exposed to infection
  - ~60% of preterm infants (<32 wks) receive PPV in the delivery room
  - Not capable of establishing and maintaining lung inflation, oxygen levels fluctuate, fetal shunts remain open

Question

- Poll audience: How many of you prophylactically intubate based on gestational age and/or weight?

Respiratory

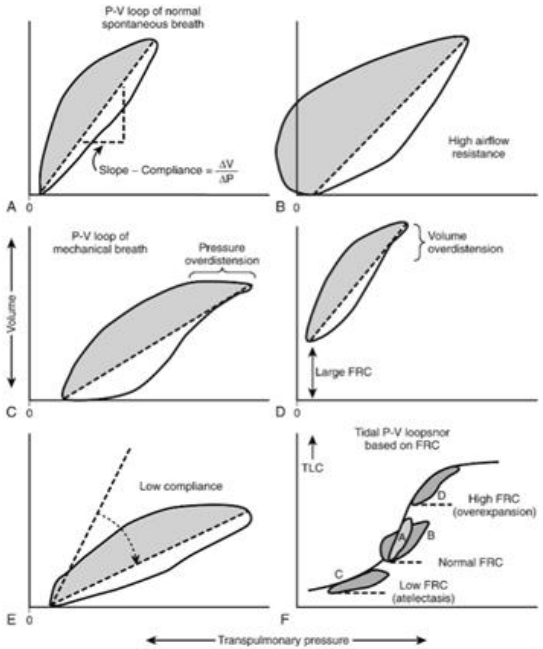
- The goal of respiratory care during the Golden Hour: Support normal gas exchange while avoiding lung injury
  - Oxygen toxicity, volutrauma/barotrauma, atelectasis
- “Encourage” spontaneous breathing
- Early positive pressure to establish and maintain FRC
  - Prophylactic CPAP vs. PPV
- Use the least invasive, most gentle approach to which the infant responds
- Avoid intubation unless necessary for apnea, inadequate heart rate, or for surfactant administration.

Respiratory

- The greatest predictor of BPD appears to be initiation of mechanical ventilation
- CPAP is a way to stabilize infants without exposing them to mechanical ventilation
- Use has now been evaluated in multiple trials
- Demonstrated as effective in infants with birth weights of less than 1000g and as young as 24 weeks.
- Equivalent or perhaps trending towards better outcomes for death or BPD.
- Must be maintained throughout resuscitation and admission, DO NOT remove for any reason!!
- Can consider NIPPV (nasal intermittent positive pressure ventilation) prior to intubation in infant needs additional support

Respiratory

- Invasive Ventilation
  - All types of mechanical ventilation injure the premature lung
  - Minimal differences in outcomes in different ventilation strategies (SIMV, HFV, etc)
  - Close monitoring and frequent adjustments.
    - VIA monitoring
    - TCM monitoring
    - Tidal Volume/loop monitoring
- Limit duration of mechanical ventilation



Respiratory

- Oxygen
  - Ideal amount of oxygen support is the least amount of oxygen needed to ensure adequate delivery of oxygen to the tissues.
  - Utilize targeted oxygen saturations, pulse oximeters, blenders, and compressed air source.
  - Clinical trials demonstrated successful resuscitation on preterm infants at 30%.
  - Maintain FRC! Open alveoli with good gas exchange will allow for decreased oxygen!

- Volutrauma/Barotrauma
  - Overdistention of alveoli and airways: Increased lung volume (stretch) and not necessarily pressure, promotes lung injury
  - Mechanical damage causes fluid, protein, and blood to leak into the airways, alveoli, and the lung interstitium, interfering with lung mechanics, inhibiting surfactant function, and promoting lung inflammation.
  - Breath to breath analysis of pressure and volume is essential-> difficult to do in the delivery room
  - Difficult to do this in the DR, mostly use chest rise/chest wall movement for assessment.
  - Limit pressure and volume without losing lung volume.
  - Maintain FRC! Avoid alveolar collapse and the pressure required to reopen alveoli!

- Atelectasis
  - Alveoli prone to collapse due to insufficient surfactant quantities or surfactant dysfunction.
  - Only a portion of the lung may be recruited and available for ventilation at any one point in time.
  - The cycle of recruitment followed by derecruitment causes lung injury.
  - Maintain FRC!
  - If intubated give Surfactant
  - improves lung inflation, improves V/Q mismatch, decreases intrapulmonary shunting, stabilizes recruited lung volume

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Golden Hour(s): Fluid and Electrolytes

Fluids & Electrolytes

- Growing evidence on the importance of early nutrition and appropriate fluid management
- Transition from fetal to neonatal life is associated with major changes in water and electrolyte homeostasis
- Goal of fluid and electrolyte therapy is to allow the appropriate changes to occur without detrimental disturbances in fluid and electrolyte status.

Fluids and Electrolytes

- Initial fluid therapy goal should allow for normal physiologic weight loss while preventing dehydration and electrolyte imbalance
  - Water accounts for 75-95% of the body weight of the neonate, depending on gestational age
  - Will lose about 15% of body weight and may take up to 3 weeks to regain birth weight
- Allow for expected weight loss and avoid excessive exogenous fluids
- Prevention of weight loss or the decrease in extracellular fluid has been associated with increased morbidities
  - BPD, IVH, NEC, PDA

Fluid and Electrolytes

- Maintenance fluid should be started as soon as access is established
- Maintenance fluid is the amount of fluid required to “maintain” the neonate and takes in to account fluid deficits/losses
- Insensible water loss (IWL): Occurs primarily through evaporation of body water through the skin, mucous membranes, and respiratory tract
  - Semipermeable skin covering
  - Warmed humidified air through respiratory tracts
  - Humidity in isolette

Fluid and Electrolytes

- Fluid rates start ~80-100 mls/kg/day
- Requirements for each patient will vary depending on clinical status/disease process

- Key data for fluid titration
  - Urine output
  - Weight
  - Serum sodium level
  - Vital signs
  - Physical exam

- Maintained until urine output increases

Fluid and Electrolytes

- Glucose
  - Fetal nutritional support is interrupted at delivery, including the supply of glucose
  - Fetus at risk for hypoglycemia due to limited glycogen stores and immature gluconeogenesis
  - Blood glucose nadir is at 30-90 minutes of life
  - Best practice is to check glucose at 30-60 minutes after birth
  - Infants need an immediate external glucose source to avoid hypoglycemia
    - GIR of 4-7 mcg/kg/hr meets basal metabolic rate

Fluid and Electrolytes

- Glucose
  - Hypoglycemia: when glucose supply and delivery is inadequate to meet glucose demand.
    - Goal is to maintain blood sugar ≥ 50 and intervene if ≤ 45
    - Hypoglycemia impacts cerebral metabolism and can lead to neuronal cell death and adverse neurodevelopmental outcomes
  - Bolus 2mls/kg D10W, must be followed by continuous infusion
  - If hypoglycemic on fluids, increase GIR by ~2mcg/kg/hr.

Fluid and Electrolytes

- Protein
  - Although preterm infant disease such as BPD, IVH, etc play a role in poor growth, over half of the growth failure in this population is due to energy and protein deficits when compared to fetal accretion.
  - Protein infusion needs to be started by 1hr of life. Benefits not appreciated during Golden Hour, but months later.
  - Evidence shows that no protein infusion for even 1 day initiates a protein deficit from which it is difficult for the preterm infant to recover.
  - VLBW infants need ~4g/kg/day to match fetal accretion
  - EUGR: Extrauterine Growth Restriction
    - AGA weight at birth falling to a SGA weight
    - EUGR @ 36 weeks/DC or later is associated with neurodevelopmental delay

Fluid and Electrolytes

- Lipids:
  - Preterm infants experience disruption in growth period including formation of adipose tissue in the third trimester
  - Glucose is primary source of energy in fetus, at birth fat becomes the main source of energy
  - Failure to provide adequate non-protein energy in VLBW infants leads to lipolysis and fatty acid oxidation for energy rather than membrane deposition in the brain which could lead to poor outcomes
  - AAP recommends an initial dose of 1-2g/kg/day increasing to 3g/kg/day in first few days
  - Keep triglyceride level < 200

Poll Question

- When do you initiate minimal enteral nutrition (trophic feeds)
  - <24 hours
  - 1st day
  - 2nd day
  - 3rd day or later

Fluid and Electrolytes

- Enteral Nutrition:
  - Human milk as “medicine”
  - Enteral intake benefits include:
    - intestinal maturation
    - Immune function
    - Improved feeding tolerance
    - Reduced liver dysfunction
  - Minimal enteral nutrition (MEN) should start as soon as maternal milk is available, ~ 6 hours post delivery in infants without intestinal pathology
  - Withholding feeds to “prevent NEC” not supported by recent evidence

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Golden Hour Tools

Neonatal Resource Team
Delivery Preparation Checklist

Resuscitation/Admission Team:
Neo:
NNP:
UC/NRT:
NRT:
RT:

Pre-admission huddle held? Y/N

Delivery Room:

OR/LDR room temp set at 78-80		Shuttle plugged in and ready	
Actual DR temp_____		notify pharmacist of pending delivery	
Omni Bed set at 37°		Bulb syringe	
Oxygen blender at 30%		Appropriate sized ETT	
Sution Catheter 8/10Fr		stylette	
Suction set at 80-100		C02 detector	
T-piece resuscitator set at 20/5		Handle and appropriate size blade	
Pulse oximeter and pulse ox probe		Neobar and measuring tool	
X2 monitor		Surfactant for < 32 weeks	
EKG leads		Multi access device for surfactant	
Blue sterile towels/baby blanket		Saline wipe	
Stethoscope		Sterile gauze	
Thermometer		Tape	
Plastic bag < 30 weeks		Ventilator; pre-calibrated	
Heated thermal mattress < 33 weeks		Mayo stand for emergent procedures	
Skin temp probe and gel heart			
2 hats; consider plastic wrap for head			
Sterile water for humidity; 60%			
Frog for midline positioning			
Intact Code Cart/ Respiratory Box			

Admission Room:

Infant pre-admitted with orders		Alaris pump; programmed with acct. #	
Unit entered in chart; monitor linked		2 brains for Alaris pump; on one pole	
Room temp set at min of 72°		orange caps on IV poll	
Central line cart		bendy bumper covers for positioning	
UAC/UVC lines prepped and ready		glucometer	
D10W & IV tubing sterily prep'd			
UAC fluids primed with transducer			
All IV tubing labeled			
Admission meds			
patient labels			
state screen form			

Golden Hour Tools

Maternal History:
To be reviewed by resuscitation team prior to delivery.

Pre Delivery Huddle Held? Y/N
Delayed Cord Clamping Plan? UCM/DCC

Mother's Name:	
Age:	
G*P*:	
Gestational Age:	
Multiple Gestation? Type?	
PNC?	
Estimated Fetal Weight:	
Membrane Status:	
PROM?	
Fluid:	
Oligo/Polyhydramnios?	
Fetal Monitoring:	
Doppler Studies:	
Maternal Labs:	
Blood Type:	
Antibody:	
Hep B:	
HIV:	
Syphilis:	
Gonorrhea:	
Chlamydia:	
Rubella:	
GBS:	
Antibiotics?	
Med:	
Time Given:	
Betamethasone:	
Date Given:	
Pain Medication	
Med:	
Time Given:	
Magnesium:	
Other Meds:	
Diabetes:	
Type:	
Med:	
Hypertension:	
Type:	
Meds:	
Congenital anomalies?	

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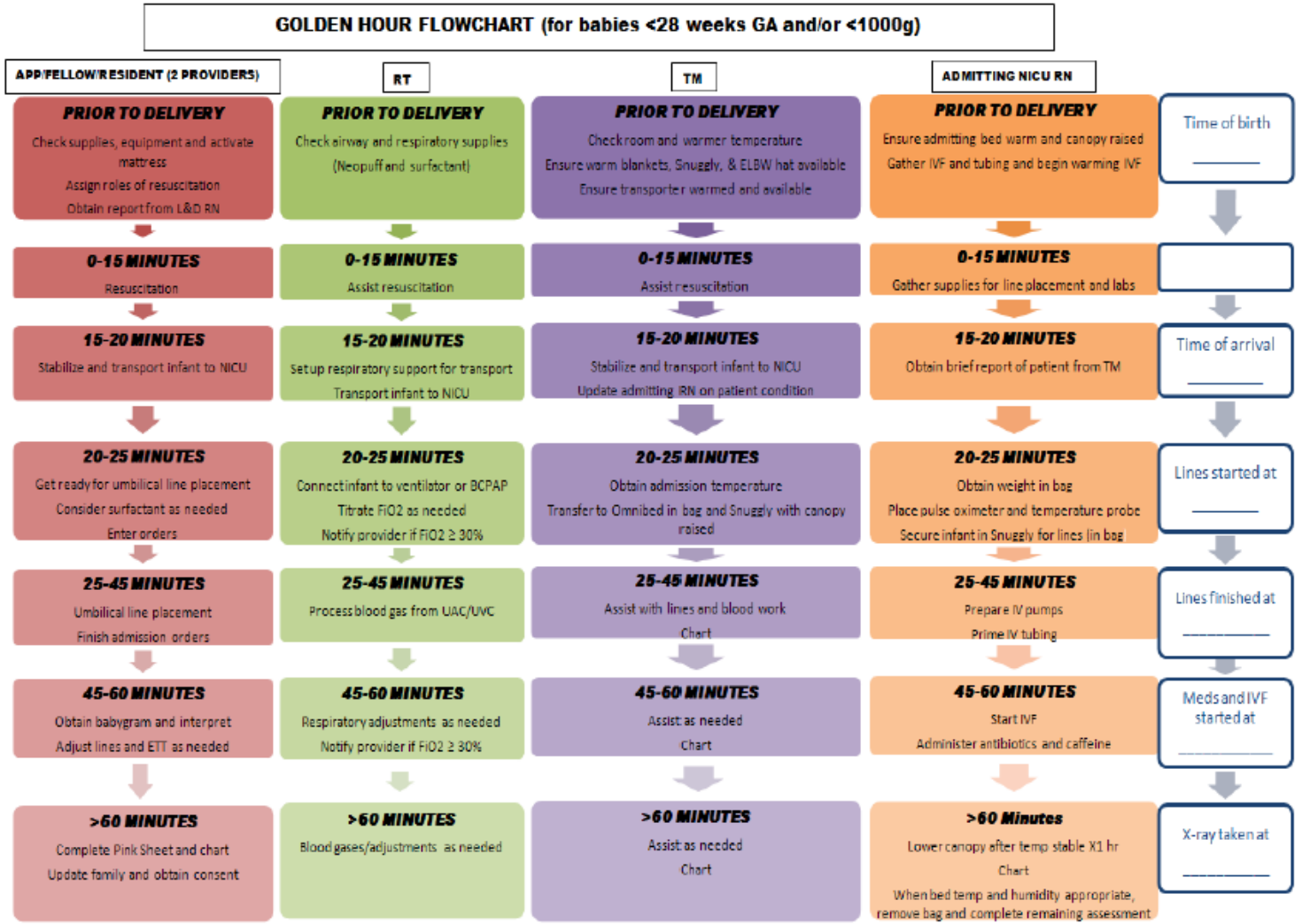
Golden Hour Protocol

	Golden Hour Protocol ≤ 32 Weeks Gestational Age			
	MD/NNP	RT	UC/NRT	RN
-30 to 0 minutes	-notify admission team; assign roles -Obtain prenatal history/complete maternal history checklist -Pend infant and sign and hold admission orders -set up for UAC/UVC placement -hold pre admission huddle to communicate history and anticipated resuscitation needs	-ensure ventilator is calibrated and in delivery room/OR -set t-piece resuscitator to 20/5 -ensure oxygen blender is at 30% -ensure sat probe/pulse ox is ready	- set up delivery room and admission room; complete delivery room checklist	- notify pharmacy of admission - sterily hang D5/D10W - sterily hang heparin flush for UAC
Birth - 1 minute	-direct/assist team -assist with polyethylene bag (<30 weeks only) -chemical mattress (< 33 weeks) -place double hat/plastic wrap -clear airway as indicated -assess for further intervention	-connect pulse ox to machine, ensure in max setting -use neopuff/t-piece resuscitator as primary mode of ventilation -establish FRC! -monitor chest rise	-place sp02 probe on right hand - place EKG leads and attach to X2 monitor -attach temp probe -assess heart rate	-catch infant from LD staff in warn sterile towels -place infant in polyethylene bag -assist team as needed
1-5 minutes	-monitor response to stabilization -maintain cpap -intubate if indicated -apnea, fi02> 50, increased work of breathing -order surfactant if indicated -initiate prep for transport	-adjust t-piece/titrate fi02 as directed -assist with intubation if indicated and secure ETT with neobar -give surfactant if indicated -place infant on vent if indicated -prep for transport	-monitor response to stabilization -assess heart rate -prep for transport when indicated -obtain weight and HC	-assist team as needed

	Golden Hour Protocol ≤ 32 Weeks Gestational Age			
	MD/NNP	RT	UC/NRT	RN
5-10 minutes	-supervise transport to unit -place additional orders as indicated (TPN/IL, gtts) -don sterile apparel for line placement	-assist with transport to NICU -monitor sp02 and adjust fi02 for NRP sat guidelines -monitor vent loops -adjust vent settings if ordered	-monitor temperature -obtain weight/HC -transport to NICU; place warm blankets on infant and utilize Omni bed shuttle	-assist with temperature monitoring -go to unit and admit patient and release signed and held orders
10-30 minutes	-place UAC and UVC (must be started within 10 minutes of arrival to NICU) -obtain labs	-monitor sp02 and adjust Fi02 for targeted sats -monitor vent loops -adjust vent settings if ordered -run ABG -calibrate VIA -assist with x-ray positioning to ensure ETT is maintained	-perform brief assessment -position babe for line placement -BP cuff on, obtain BP -admission meds -monitor temperature -first blood sugar at 30 minutes	-assist with monitoring -assist with documentation -assist with x-ray -hang TPN/drips sterily once available
30min-1 hour	-evaluate CXR/KUB adjust lines -complete assessment -review ABGs/labs -update family -debrief team -initiate Vital 5 protocols *try and limit line attempt time to 30 minutes total; consider PIV/PICC/PAL if unsuccessful*	-initiate VIA -obtain iSTAT ABG at same time as initial VIA ABG for comparison -target ph: >7.25 C02: 45-55 02: 50-70 -adjust vent/fi02 as indicated -monitor vent loops	-connect prestrung IVF to UVC as soon as access is established -obtain labs -give antibiotics -close isolette -monitor temperature -secure umbilical lines -initiate UAC fluid -monitor temperature	-assist with monitoring -assist with documentation -hang TPN/drips sterily once available -keep family updated

Golden Hour Protocol



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Golden Hour Protocol

Patient Sticker

Golden Hour Protocol

≤ 30 weeks EGA

DR Preparation

- *Environment:*
  - **DR temperature 77-79°F**
  - Isolette in radiant warmer mode for resuscitation/stabilization
  - Warm blankets and hat readily available and placed onto radiant warmer
  - Neodrape available for use
  - Gather supplies and have at the admission bedside a double lumen UVC and single lumen UAC
- Communication:
  - ***UNLESS*** there is an abruption or severe fetal distress, advise OB to perform delayed cord clamping **for 60 sec**. For C/S, OB to place on sterile drape for stimulation during DCC; if vaginal, may place infant onto warm towels during DCC then pass to the RN after clamping
  - ***IDENTIFY*** support person and update them (and Mom if able) regarding delivery plan
- *Developmental:*
  - Prepare 'nest' on radiant warmer where infant will be placed
  - ***ATTENTION*** to sound, light, and handling as environmental stressors to the premature infant
- Respiratory:
  - Ensure O2 blender at 30%, availability of Neopuff and BCPAP, appropriate size masks, ETTs and Surfactant
  - Neopuff in DR checked for PIP of 20, PEEP 5
  - Ensure Neopuff and/or self-inflating bag and mask and at least 1 suction set-up available at the bedside in the NICU

EGA: _____

Delayed Cord Clamping
Y N

If No, why:

_____

Time: _____s

DR Care

Perform NRP Resuscitation Guidelines

RN	RT	Practitioner
Step 1: ❖ Place Infant on Neodrape which has been placed on pre-warmed towels for resuscitation and then wrap infant in Neodrape ❖ **KEEP HEAD MIDLINE** ❖ **ATTENTION** to developmental handling ❖ Pulse ox probe on R hand prior to plugging in ❖ Obtain and document length, weight, HC	**Step 1:** ❖ Use Neopuff CPAP at initial FiO2 of 30% as primary mode of oxygenation/ventilation ❖ Adjust FiO2 with pulse ox guidelines for age in minutes ❖ Administer Surfactant if intubated ❖ Prong ONLY if on BCPAP in the DR ○ Use largest PRONG size appropriate for infant	**Step 1:** ❖ Administer Sufactant if intubated ❖ Consider Surfactant: ○ FiO2 >40% on BCPAP ○ PEEP ≥ 6 ○ Excessive WOB

HC: _____ c

Length: _____

Weight: _____

Apgar: 1 min _

5 min ____ 10 m

Surfactant Y N
Time of Surf:___

Transition to NICU

RN	RT	Provider
Step 2: ❖ Perform essential assessment only (i.e. auscultate, assess perfusion, VS off monitor) ❖ Secure infant for umbilical line placement ○ Be conscious of developmental positioning ❖ Ensure Temp probe secured to infant and bed on ISC control ❖ String Starter TPN and UAC fluids (if ordered) for central line delivery ❖ Maintenance IVF hung prior to CXR if felt by practitioner to be in an adequate position with good blood return ❖ Prepare isolette for humidity per protocol	**Step 2:** ❖ Adjust FiO2 for O2 Targeting ❖ Assure adequacy of BCPAP and use of Duoderm as a barrier ❖ Remain at infant's bedside during initial line placement to ensure infants status remains stable ❖ Once infant stabilized may leave bedside ❖ Perform I-STAT labs as indicated	**Step 2:** ❖ UVC double lumen for all infants UAC based on clinical condition ○ Begin line placement within 15 minutes of arrival to NICU ○ Povidone Iodine for sterilization ❖ Place double lumen UVC first and begin IVF immediately once good blood return obtained and labs drawn. **DON'T** wait for XRAY ❖ Delay antibiotics and vasopressors until line placement is verified by xray *Limit attempt time for UVC/UAC to 30 minutes total. (If UAC necessary and unsuccessful can reattempt at later time or place PAL)*

Central Lines:
Start Time: _____

Finish Time: _____

UVC Successful: Y N
UAC Successful: Y N N/A

Fluids (circle one):
D10W Starter TPN

Time Hung: _____

Starter IL Y N

Time Hung: _____

Admit Rectal Temp:
_____

Post DR Transition

RN	RT	Provider
Step 3: ❖ Update family at bedside ❖ Confirm line position per CXR ❖ ABX and Pressors ONLY after UVC verification per CXR ❖ Complete admission assessment ❖ Close Isolette and start Humidity per protocol	**Step 3:** ❖ Wean Vent settings and FiO2 as indicated	**Step 3:** ❖ Update Parents ❖ Additional Provider to gather history, place orders, and update family as indicated

Surfactant after admit
Y N

Time of Surf: _____

Family Updated:
M D Other

Time: _____

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