1. **PURPOSE:**

This department manual guideline has been created to frame an active and consistent therapy approach to the infants born at 22 0/7 to 24 6/7 weeks with the purpose of reducing variability to improve outcomes. Comfort care is recommended prior to 22 weeks. Infants <23 weeks, when requested by mother, can have resuscitation limited to intubation and airway management only. A fully active therapy/resuscitation includes a multidisciplinary approach with prenatal steroids, c/s delivery for NRFS, prenatal consult with neonatology team, neonatologist and team attendance at delivery, and parental autonomy in highest regard.

|  |  |
| --- | --- |
| **EGA** | **Recommended Care** |
| <22 weeks | Comfort Care Only |
| 22 0/7 – 23 6/7 weeks | Limited Resuscitation Offered (Airway, PPV, Intubation) |
| >24 weeks | Full Resuscitation |

1. **DEFINITIONS:**

When used in this department guideline, these terms have the following meanings:

C/S – Cesarean Section

TBC – Tiniest Baby Collaborative

NRFS – Non reassuring fetal status

1. **DEPARTMENT MANUAL:**
2. Tiniest Baby Team is a multidisciplinary team including the following specialties:

Neonatologist, RN, RT, NNP, Chaplain, Palliative Care, Social Work, Nutrition, Pharmacy, Lactation, pediatric medical/surgical specialties, and parents. These specialties and family will collaborate to enhance survival and outcomes of this very fragile population utilizing the evidence-based protocols below.

1. Protocols are as follows:

|  |  |  |
| --- | --- | --- |
| **Attachment** | **Protocol** | **Page Number** |
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| Attachment B | TBC Survival/Disability Sheet | 6 |
| Attachment C | Handout to Parents | 8 |
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**Attachment A - TBC Consult Template**

**Prenatal Tiny Baby Initiative (TBI) Consult**

**(22 0/7 – 24 6/7 weeks)**

**Patient Population:**

Obstetrical patients who are anticipated to deliver between 22 0/7 weeks and 24 6/7 weeks gestation. Consults begin at 21 5/7 where a multidisciplinary team discusses use of steroids.

**Purpose of the Consult:**

1. Provide information to the parents that will be helpful in their decision to allow for a natural death including comfort measures vs. allowing a trial of therapeutic intervention for their periviable infant.
2. Provide the family the opportunity to meet the Neonatal Team prior to the delivery room.

**Procedure:**

*Follow all content of the consult template.* Patients will be identified by the Obstetrical or Maternal Fetal Medicine teams. A call will be placed to the NICU requesting a TBI consult. The consult will be completed as soon as possible. A written consult will be placed in the maternal chart or sunrise.

Diagram

Description automatically generated

***Obstetric Considerations:***

Transfer of mothers can be considered at 21 0/7 week if OB/MFM feels there is a chance to make it to 22 0/7 weeks prior to delivery.

**Personnel:**  
Ideally the TBC consult will be completed by a multi-disciplinary team including: Neonatology, Palliative Care, OB and/or MFM, the OB nurse caring for the mother and care management team from the NICU. A STAT consult should be seen within 4 hours for imminent deliveries. Make every effort to include palliative care.

*\* Video Conference may be available for outpatients.*

**TBC Consult**

Date:

Patient Name:  
Medical Record Number:

Maternal History:

Ms. \_\_\_\_ is a y/o G\*P\*\*\*\* mom with an EDC of \*\*/\*\*/\*\*\*\* placing the fetus at \_\_\_\_ weeks of gestation. The pregnancy has been complicated by: \_\_\_\_\_

The consult was done in the presence of \_\_\_\_ on the antepartum unit where Ms. \_\_\_\_\_\_ has been admitted. We began by discussing the current survival statistics (and the limitations of those statistics) at WPH for infants delivered at 22 weeks gestation i.e. 30%, and that survival / prognosis improves with each week of gestation. Variables affecting survival were reviewed, including antenatal steroids, complications of pregnancy, neonatal infection as well as gender and race. In addition, the high risk of long-term disabilities were reviewed including, but not limited to: chronic lung disease mental retardation, cerebral palsy, blindness, deafness, and learning disabilities/need for special education. I/we explained to the parents that considering the high risk of mortality and morbidity in infants <24 weeks that allowing a natural death with the provision of comfort measures would be a reasonable option. This approach was discussed in detail.

We then discussed the option of a trial of therapeutic intervention for their peri-viable child that would include: 1. The neonatal team being present at the delivery. 2. The potential for antenatal plans to change based on the gestational age assessment and/or condition of the infant. 3. Resuscitation and stabilization will be limited to temperature control, airway management and respiratory support. (Further resuscitation measures, such as chest compressions and epinephrine have been found to be futile and will not be offered.) 4. If the infant is too small to be intubated or not responding to resuscitative measures care will be redirected, the parents will be encouraged to hold their baby and comfort measures will be provided as needed.

The parent(s) understood that if resuscitation is successful that morbidity and mortality still remains high at this gestation. We discussed the intense monitoring of the infant in the NICU, the likely need for umbilical catheters, central lines and blood products. Potential complications including but not limited to: hypotension, IVH, spontaneous perforation, infections, necrotizing enterocolitis and renal insufficiency were reviewed. We also discussed the option for the parents in combination with the neonatal and palliative care team to redirect care based on the clinical course and complications following admission to the NICU.

Mom expressed her desire to: allow a natural death and comfort measures / allow a trial of therapeutic intervention. Mom's nurse and the OB attending or MFM attending of record were updated regarding the mom’s wishes (If they were not present during the consult).

Thank you for the opportunity to participate in the care of this lovely mother. If further questions arise we would be happy to address them.

**Attachment B – Handout to Parents**

As your partner in care for your tiny baby, the specialists at Orlando Health Winnie Palmer Hospital for Women & Babies want to provide you with all the information, compassion and support you need at this time. We are here to answer the questions that guide your decisions for your child and your family.

**Survival**

Despite advances in medicine and the quality of care available at Orlando Health Winnie Palmer, extremely premature infants are at high risk. At this time, the worldwide medical community recognizes that the earliest gestational age where survival may be possible is 22 to 23 weeks. For babies born younger than this, we must focus on giving you quality time with your baby before an expected death.

Here are considerations that affect survival of tiny babies:

* When it comes to gestational age, every week -- even every additional day – matters
* Growth also matters -- appropriate growth before delivery improves survival
* Females have a better chance of surviving premature birth than males
* Race and ethnicity play a role in the chance of survival
* Pregnancies with only one child (rather than twins or triplets) have a greater chance of survival
* Steroids given prior to delivery improve the chance of survival
* Infection in the infant reduces the chance for survival
* Congenital anomalies or malformations can reduce the chance of survival
* Delivery in a hospital with a NICU improves survival and outcomes

**Complications and Disabilities**

For extremely premature infants who survive, the risk for long-term complications remains high. These complications may include:

**Neurologic impairment**These impairments may range from mild to severe and could include any of the following:

* Intellectual disability – This is a cognitive impairment (the ability to think), which could result in a very low intelligence quotient (IQ).
* Severe Cerebral Palsy – This relates to how children use their muscles. Some children may progress to being able to climb stairs while holding onto a railing or with supervision and assistance. Others may need a lifelong mobility device, such as a wheelchair.
* Blindness or profound hearing impairment -- This could be progressive or permanent.

**Bronchopulmonary Dysplasia (BPD)**

BPD is a lasting lung disease caused by ventilator and long periods of oxygen use in infants. While these breathing machines save lives, they also put stress on the lungs over time. Some babies may go home on a small amount of oxygen, while a small number may need home ventilators. Discharge on a ventilator requires a surgically placed breathing tube inserted into the airway through the neck (a tracheostomy).

**Growth/Nutrition Deficiencies**

Some extremely premature infants have difficulty eating enough by mouth when they get older. In these cases, a surgically placed feeding tube (G-tube) may be necessary for some time.

**Care Options for Babies Less Than 24 Weeks Gestation**

Considering the high risk of both complications and death for these infants, families have two options to consider. We believe that both of these options are legally, morally and ethically appropriate and we support whatever decision your family makes.

1. **Begin a trial of care focused on survival**Understanding the risks and complications, you may choose to begin a trial of medical care. This care will likely include using medications, such as steroids. The neonatal team will respond to the condition of your baby at the time of delivery. Resuscitation will be limited to helping your baby breathe, as chest compressions do not increase survival and are painful for your child. Once your baby has been stabilized, we will bring them to you before quickly transporting them to the NICU for further care. If your baby is too small to be intubated or is not responding, care will be redirected to providing them comfort.
2. **Optimize quality time**   
   While allowing for a natural transition to death, we focus on measures to keep your baby comfortable. We assist you in making memories, including photography, footprints, fingerprints, baptism/blessing and the presence of your family, friends or religious support. Medications may be used to keep your baby comfortable. Please be aware that tiny babies may continue to have signs of life such as movement, breathing, and heart rate following delivery. These signs of life do not mean that your baby has a better chance of long-term survival than we have discussed.

**Care at Orlando Health Winnie Palmer**

While delivery in a hospital with an expert NICU improves a baby’s chance for survival and outcome, the reality is that not all babies can survive or overcome serious disability. Here are the facts on our outcomes, which may be helpful to you in making decisions for your family.

**Attachment C - TBC Survival/Disability Sheet**

**Survival and Outcomes for Babies Born at 22-24 weeks at**

**Orlando Health Winnie Palmer**

**DESIRED OUTCOMES ARE IN BLUE, UNDESIRED OUTCOMES ARE IN RED**

Survival statistics are averages over the last three years at Orlando Health Winnie Palmer. Numbers in parenthesis are exact percentages. Disability statistics are from published studies from multiple centers. Severe disabilities have been defined above under *Complications and Disabilities*.

|  |  |
| --- | --- |
| **22 WEEKS** | |
| **SURVIVAL** | **DISABILITY** |
|  |  |
| **3 of 10 babies survive (40%)** | **2 of 3 without severe disability (66%)** |
| **●●●●●●●●●●** | **●●●** |
| **7 of 10 babies die (60%)** | **1 of 3 has severe disability (33%)** |
|  |  |
| **23 WEEKS** | |
| **SURVIVAL** | **DISABILITY** |
|  |  |
| **6 of 10 babies survive (60%)** | **3 of 4 without severe disability (75%)** |
| **●●●●●●●●●●** | **●●●●** |
| **4 of 10 babies die (40%)** | **1 of 4 has severe disability (25%)** |
|  |  |
| **24 WEEKS** | |
| **SURVIVAL** | **DISABILITY** |
|  |  |
| **7 of 10 babies survive (74%)** | **6 of 7 without severe disability (75%)** |
| **●●●●●●●●●●** | **●●●●●●●** |
| **3 of 10 babies die (26%)** | **1 of 7 has severe disability (14%)** |

**Attachment D – TBC Palliative Care Guidelines**

**GOAL**

To optimize and improve the quality of care for extreme prematurity babies considering significant morbidity/mortality which impacts the quality of life for these babies.

1. TBC consults should include a Palliative Care consult in conjunction. If possible, consideration for joint TBC prenatal consult (NICU & Palliative Care) should be pursued.
2. If a family decides to not pursue NICU intervention for extreme prematurity (22-23 weeks gestation), then palliative care should manage end of life care through multidisciplinary support and comfort measures including sublingual medications as appropriate.
3. Extend limitations for resuscitative efforts from time of delivery to 6 weeks of life given overall poor prognosis, with no cardiac medication boluses and no chest compressions for hemodynamic compromise. Families should be informed of this limitation at time of prenatal consultation. Note: A sudden deterioration in an otherwise stable patient should allow for physician discretion in determining any easily reversible causes.
4. Consideration of withdrawal of non-beneficial life-sustaining therapies and/or re-direction of care if the baby develops 3 organ dysfunction (including respiratory failure given prematurity). Offering compassionate extubation of ventilator on the 11th floor should be considered standard for end of life care for TBC babies. If the mother is an inpatient, the baby may be taken to the mother’s room.
5. For 22-23 weeks gestation: there should be mandatory multidisciplinary care conferences at set intervals to enhance communication and discuss goals of care given evolving clinical course for TBC with importance given to early hospitalization course. First multidisciplinary care conference should ideally occur between 48 – 72 hours, but within the first week of life involving the active healthcare team. Second multidisciplinary care conference should occur between 8 - 14 days and additional care conference should occur as needed for any acute change in clinical condition.

**Attachment E – TBC Admission Checklist**

|  |
| --- |
| **SETTING UP FOR YOUR TINY BABY** |
| Full Isolette Cover Eye Shield 3-4 IV pumps PIV set-up |
| Stocked Sterile Line Cart (towels, gowns, 3.5 catheters, UAC trays, hats, masks, sterile gloves) |
| Positioning Aid (i.e. dandle roo/2 dandle pals) Package of small diapers |
| Sterile Water Bottle for humidity set up Monitor Cables (including UAC) |
| Heat lamps x2  IVFs (D5wStarter TPN & ¼ Na Acetate w/h hep) |
| HFJV at bedside, set up and ready to go 0.2 NSS Flushes (may override) |
| Sterile Tubing set up (UAC with transducer/UVC/Sterile gowns & gloves/Sterile drape/Hat & masks) |
| Ensure Neo Workup & Blood Culture drawn in delivery room from cord blood with patient & mom label on it |
| Meet with team helping admit patient for role designation and plan |

|  |
| --- |
| **Admission Check List** |
| Golden Hour: emphasis on surfactant delivery, line placement, IV fluids started, temperature preservation |
| X-ray within minutes of getting to unit to confirm ETT placement |
| Surfactant delivery after ETT confirmed in correct place (can be done during line placement) |
| Restrain only baby’s lower extremities with legs down and diaper taped over them; or as per NNP/MD request |
| Tubing to be prepared ASAP with goal to start fluids once lines in place (this would be the time to obtain your  admission weight, BP, temp, measurements, labs (if needed), etc) |
| X-ray to confirm line placement; once confirmed, secure lines per protocol |
| Complete admission process being mindful of infant’s temp. and stress level (this would be the time to obtain  your admission weight, BP, temp, measurements, labs (if needed), etc) |
| Remember to check your patient’s blood sugar 30-60 minutes after hanging fluids |

|  |
| --- |
| **Important Considerations** |
| Use heat shield whenever accessing patient |
| Maintain baby in midline position with nose/chin/umbilicus in line throughout admission and for the next 72\* |
| Debrief with team to be conducted once baby admitted and settled |
| Please be aware of noise level and lighting to baby throughout the admission process |
| TINY BABY ADMISSION CHECKLIST |

**TBC DR EQUIPMENT CHECK LIST**

|  |  |  |  |
| --- | --- | --- | --- |
| **RN** | | **RT** | |
|  | Room temp to 78 degrees |  | 0,00,000 Blades |
|  | OMNI bed with top up |  | 2.5/2.0 ETT |
|  | Manual temp override |  | Stylet |
|  | Polyethylene bag |  | Co2 detector |
|  | Thermo hat |  | 2 small masks |
|  | Temp probe |  | Neopuff 22/5 0.25 FiO2 |
|  | Cardiac leads / SpO2 probe |  | Pulse oximeter/probes |
|  | Cardiac monitor |  | Suction/delee |
|  | Nesting supplies |  | ETT tape |
|  | Tortle |  | Check tanks/key |
|  | Recording sheet |  | Bottle sterile water |

**Attachment F – TBC Golden Hour Worksheet**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time | MD/NNP | RN/RN2 | RT | Admit Team (RN/RT) | Time |
| Pre | Obtains history  Reviews consult  Assigns duties  Checks equipment | DR temp to 78  Prewarmed Omni bed-top up  Monitor/DR equipment/checklist  Give sterile bag to OB | Resuscitation equipment  Check Tanks  Shuttle (if available) | Complete admission check list  HFJV- setup | Please utilize  phone or  computer |
| Birth - 15m | Airway (head of bed)  Assign APGARs  Updates Family  Monitors time | Nest, midline position  Apply leads & temp probe  Weigh  Prepare Omni bed for transfer  Call admit info to unit/request CXR | Secure airway  Prepare vent/tanks for transfer  Call settings to admit RT  Request Surfactant to bedside | Obtain IV Tubing & prepare | Birth:  Out: |
|  | Reviews CXR/settings | **ADMIT TO NICU with CXR on Admission** |  | Raise Omni bed top | Admit:  CXR: |
| NICU  20m – 40m | Admit orders  Place Lines (piv if unable to obtain within 15 min)  Obtain admission blood work |  | **ADMIT RT**  Ventilator  Administer Surfactant | Attach monitor  Obtain temp  Secure temp probe  Secure for baby lines  Prime IV tubing | Temp:  SURF::  UAC:  UVC:: |
|  |  | **LINE KUB/CXR** |  | TOP down | Xray: |
| 40m – 60m | Confirm line placement |  | ABG | Begin TPN via UAC  Verify temp  Begin humidity  Administer antibiotics | TPN:  Temp:  Abx: |
|  | DEBRIEF |  |  |  |  |

**Name**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **MR#**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **DOB/TOB**\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **GA**\_\_\_\_ **BW**\_\_\_\_\_\_ **Delivery:** c/s vag

**Admit VS:** Temp\_\_\_\_ HR\_\_\_\_\_ RR\_\_\_\_\_ BP\_\_\_\_\_\_\_\_\_\_ SpO2\_\_\_\_\_\_ FiO2\_\_\_\_\_\_ Vent\_\_\_\_\_\_\_\_\_\_

**1 Hr. VS:** Temp\_\_\_\_ HR\_\_\_\_ RR\_\_\_\_ BP\_\_\_\_\_\_\_\_\_\_\_ SpO2\_\_\_\_\_\_ Fio2\_\_\_\_\_\_\_\_ Vent\_\_\_\_\_\_\_\_\_\_ Blood Glucose\_\_\_\_\_\_\_\_

**Debrief Notes:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Team Leader Signature**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Not OFFICIAL Medical Record**. Please return to Amy Kelly-Vega APRN or Allison Ramey RN

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**Attachment G – Respiratory Care of the TBC**

1. **DEFINITIONS:**

When used in this department guideline, these terms have the following meanings:

ABG – Arterial blood gas

CXR – Chest x-ray

C/S – Cesarean Section

DOL - Day of life

DR – Delivery Room

HFJV – High Frequency Jet Ventilation

iNO – Inhaled Nitric Oxide

NAVA – Neurally Adjusted Ventilatory Assist

NRFS – Nonreassuring Fetal Status

NRP – Neonatal Resuscitation Program

SMOF – SMOF lipids – **S**oybean Oil, **M**edium-Chain Triglycerides (MCTs), **O**live Oil, & **F**ish Oil

TPN – Total Parenteral Nutrition

UAC – Umbilical artery catheter

UVC – Umbilical venous catheter

VBG – Venous blood gas

1. **DEPARTMENT GUIDELINE:**

1. Review of DR Management

1. NRP guidelines should be followed
2. Intubation by most experienced person (determination by Neonatologist)
3. Do not perform sustained lung inflation (SLI)
4. Admit to Omnibed (See Omnibed recommendations)
5. Observe strict Oxygen saturation - Initial FiO2 0.30 Increase Fi02 as needed to establish circulation & HR
6. Tape ETT at ~5.5 cm at the lip – tube depth may be adjusted after completed CXR

|  |  |
| --- | --- |
| Target pre-ductal SPO2 after birth | |
| 1 min | 60%-65% |
| 2 min | 65%-70% |
| 3 min | 70%-75% |
| 4 min | 75%-80% |
| 5 min | 80%-85% |
| 10 min | 85%-95% |

**2. Chest X-Ray**

* 1. Grand Station to call radiology prior to arrival of infant
  2. Immediate CXR on arrival to NICU confirmation of ETT placement
  3. CXR 2 hours post surfactant administration to avoid hyperinflation.
  4. CXR q12-24 & PRN first 4 DOL.

**3. Surfactant Administration Initial**

1. Surfactant at bedside prior to arrival of infant
2. Have tegaderm and white cloth tape pre-cut at bedside prior to infant arrival
3. Reposition and re-tape ETT if indicated per CXR
4. Administer surfactant immediately after ETT confirmation via CXR
5. Surfactant may be administered during line placement – do not wait

**4. HFJV First Line Intention – Infant to be kept on HFJV for minimum of first three (3) weeks of life, pending decision by TBC neonatologist.**

***Initial Jet Settings***

Jet PIP 22 – 24 cmH2O (If “wiggle” inadequate notify Neo)

Jet Rate 360 bpm

Jet Ti 0.02 Seconds

IMV PEEP 5 cmH2O (Adjust per CXR)

IMV PIP 1+PEEP

Rate 2 bpm

IMV Ti 0.5

***Sigh Breaths:*** ***Once Initiated Patient Remains On, Unless Air Leak Develops***

Sigh breaths may be added per TBC attendings discretion, for ongoing alveolar recruitment, especially

wandering, focal, patchy atelectasis, or severe apnea. Try to avoid the use of sigh breaths within the first 72

hours.

IMV Rate 4-12

IMV PIP 5-10 above PEEP

IMV Ti 0.5

No need to wean rate unless air leak develops

***Recruitment Maneuver:*** *Temporary airway pressure increase to open collapsed alveoli*

IMV Rate 2-8 ***Above*** Current IMV Rate

IMV PEEP 1-2 Increase (Maintain increased PEEP post recruitment)

IMV PIP 2-8 ***Above*** Current IMV PIP (always at least <2 JIP)

Ti 0.5-0.6

***Recruit for at least 1 hour***

***PIE Developing***

Jet Rate decrease by 60 to low of 240 bpm (as tolerated)

Tolerate higher FiO2

**Prior to escalation of settings evaluate the following:**

ETT position in relation to CXR & patient position

Wiggle

Patient Activity (sedation needed, patient containment)

Need for suctioning

Expected Jet Adjustments

Increase Jet PIP 1-2 = Decrease pCO2  2-4mmHg ( & vice versa)

Increase Jet PIP 2-4 = Decrease pCO2 5-8 mmHg ( & vice versa)

**5****.** **Surfactant - Subsequent**

1. TBCs may require multiple surfactant doses due to extreme prematurity. Additional dosing may be given at 12, 24, or 48 hours of life. Surfactant >48 hours determined on individual patient basis.

**6. Obtain ABG/VBG Within First 60 Minutes of Initiating HFJV**

* 1. Draw immediately after line placement
  2. Gases q3 hrs. until CO2 45-55 x 3, then gases q6 hrs. until discontinued by MD.

**CO2 Target – CO2 are highly variable**

45-55 (First 72 hrs)

45-60 (>72 hrs)

* 1. If no SMOF or TPN running through line draw blood waste ***just*** to clear line. Draw and return waste ***slowly*** over 1 minute. Sample size for blood gas 0.2 cc.
  2. Flush line with 0.2 cc NS for first 7 DOL. Special flushes kept in Omnicell.

**7. Target Saturation - At 21% upper alarm may be 100**

85-93% (Alarms 80-95)

90-95% >32 wks. (Alarms 85-98)

>32wks/RA/<1lpm: O2 Target >94% (Alarms 90-100)

**8. Avoid unintended extubation**

* + - * 1. ETT to be cut at 13cm once on conventional ventilator for 24 hrs.
        2. Most experienced individual should reintubate should unintended extubation occur – MD to be called during extubation to collaborate with team regarding appropriate actions.

**9. Extubation Criteria/Plan**

* + - * 1. Ideally, patients can be extubated from HFJV to iNAVA or NIV NAVA at ~28-29 weeks and/or >850grams.
        2. Use mask or nasal prongs **(NOT RAM)** interchangeably. Always apply protective barrier
        3. Those with MAPS > 10 will be placed on iNAVA first.

**10. Nitric Oxide**

1. iNO may be considered as a rescue treatment when infant is nonresponsive to other treatments and FiO2 > 60 with concern for pulmonary HTN
2. iNO should be initiated at 10-20 ppm and decreased if patient is non-responsive to therapy
3. Ideally ECHO should be utilized for confirmation
4. Discontinuation and weaning of iNO will be done in collaboration with TBC team

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**Attachment H – Nursing Care in the TBC**

1. Tiniest Baby Team is a multidisciplinary team including the following specialties:
   1. Neonatologist, RN, RT, NNP, Chaplain, Palliative Care, Social Work, Nutrition, Pharmacy, Lactation, and parent
2. Rounds are completed daily starting at 0900 with the expectation that everyone attend as able
3. PT to become part of the team once baby reaches 28 weeks corrected
4. Pre-delivery
   1. TBC ALERT
5. When delivery of an infant meeting criteria is determined to be pending a TBI alert will be initiated which includes notification to charge nurse and respiratory lead.
   1. Equipment
6. An omnibed will be prepared by DR team using sterile linens and will be pre-warming in hallway
7. HJV- Calibrated and ready at admission bedspot
8. The following supplies should be placed in drawer of Omnibed and available for use by team in DR
   * + 1. EKG leads, Polyurethane bag, Insulated Thermo hats, preemie soft mask, Suction catheter, neopuff, laryngoscope blade (00), umbilical line tray, pulse oximeter, Omnibed cover
9. Delivery Room:
   1. Team attending delivery will brief to review plan for delivery including:
10. Breakdown of roles of team and expectations of neonatologist as well as checklist for duties during delivery
11. Actions to take if infant fails to respond to resuscitation
12. Plan for mother/family bonding in the delivery room
    1. Delivery Team should include the following team members:
13. Neonatologist, 2 RNs, NNP, and RT
    1. Omnibed will be brought down by team attending delivery and set up for resuscitation
14. If unable to get Omnnibed down in time for resuscitation, Omnibed will be available to transport infant back to NICU
15. Upon arrival to DR, the top of the Omnibed will be opened and used as a radiant warmer – temperature to be raised to 100%
16. Apgar timer on Omnibed to be used
17. Infant to be weighed using Omnibed scale (if possible, may be done in NICU)
18. Close Omnibed once infant stabilized

Team to wait until Omnibed warms up to transfer patient to NICU

Utilize shuttle as able and available

* 1. Delayed cord clamping for a minimum of 45 secs up to 60 seconds unless contraindicated by patient’s status
  2. Facilitate bonding process for mother/father in DR
  3. RN to call secretary to initiate admission into unit; secretary to notify Radiology to come to unit for initial XRAY
  4. Bloodwork in DR – cord blood to be sent for neonatal screen and culture to be obtained by L&D team if possible
     1. RN to ensure that blood is collected sterilely and labeled properly.

1. Golden Hour/Admission:
   1. Omnibed to be plugged in immediately and top of bed raised with heater at 100%.
      1. Omnibed used as a radiant warmer until all procedures completed including line placement, IVs.
      2. Omnibed should only be closed when all care is finished to prevent temperature instability from opening and closing.
   2. Radiology should be at bedside upon arrival to unit to take initial XRAY and confirm ETT placement
   3. Line Placement
      1. To be done by most senior/experienced personnel.
      2. A UAC and UVC will be attempted
         1. Fluids should be available and primed in tubing during line placement with goal to have fluids running immediately after line placement is confirmed but no later than 60 minutes into admission.
            1. UAC fluids should start once blood is confirmed (usually before Xray is taken)
      3. 0.2% NaCl flushes without heparin made specifically for the TBI will be used to flush lines and can be found in the refrigerator at grand station
         1. Use these flushes for all line the first 7 days. After 7 days return to regular NS and/or Heparin flushes, whichever is appropriate for the type of line.
            1. Exception: If a PICC line is being placed prior to 7 days, Heparin Flush should be ordered and utilized during the placement of the PICC line. After the line is secured and regular fluids are running, you may go back to the NS flushes until the 7th day. If a double lumen catheter is placed and one of the ports is to flush for medications, the “flush” should be heparinized flush.
   4. Admission labs:
      1. Blood culture (preferably one from cord as well as from baby), Blood Gas (Arterial or Venous), Infant Screen, Neonatal Workup (if cord blood not sent)
2. Daily Care/Management:
   1. Ominbed management
      1. Bed to be changed at 1 month and switched to regular giraffe isolette.
      2. Humidity:
         1. Humidity to start at 70%
         2. Linens to be changed every 24 hours UNLESS the infant is having thermoregulation problems or the linens are damp.
         3. Weaning of humidity to start on DOL 7 if skin assessment scores are appropriate
   2. PICC line to be inserted on DOL 4-5
   3. Prevention of IVH
      1. Positioning/Turning
         1. Infants head must remain in midline with the head of bed 15-30 degrees elevated for the first 72 hours.
         2. After 72 hours, infants should be turned from prone to supine or supine to prone by gradually changing position over 20 minutes.
            1. To prepare for physical exam by neonatologists in the morning, nurses are asked to begin the turning process at the beginning of the shift. Physicians and NNPs will be asked not to examine the infant unless they are felt to be ready by the nursing staff.
   4. Infection Prevention/Sepsis Management:
      1. Prevention of infection using the following strategies
         1. Strict hand hygiene, all glove care, gentle handling with minimal use of adhesives, no topical emollients to skin, use of human milk within 24-48 hours of birth, individual stethoscopes, encourage kangaroo care, aggressive early weaning from invasive mechanical ventilation to non-invasive, cautious use of antibiotics and steroids, and avoid acid suppression
         2. All supplies should be cleaned using hospital approved cleaner every shift.
         3. All babies under the TBC will be placed on sterile linens for the first 10 days of life.
         4. Skin to be checked by 2 licensed professionals for first 10 days of life to check for alterations.
         5. Umbilical Line Management
            1. Aseptic catheter insertion with maximal sterile barrier after cleaning site using an antiseptic (i.e. povidine-iodine)
            2. Avoid using topical antibiotic ointment or creams on insertion sites
            3. Line to be cleaned from umbilicus up with betadine, followed by sterile saline every shift.
            4. Note times of accessing line in observation column.
            5. UAC – remove and do not replace if signs of CLABSI, thrombosis, or vascular insufficiency in the lower extremities are present
            6. UVC – remove and do not replace if signs of CLABSI or thrombosis are present
      2. PICC line management
         1. Team will reassess need for PICC line
         2. Twice weekly Fluconazole prophylaxis not to exceed 6 weeks of total duration
      3. Lab Work
         1. A minimum of 1 ml of blood is needed for blood culture obtained either through UAC shortly after placement or peripheral vein culture if not done with cord blood.
         2. Lumbar Puncture – should be performed in any infant with a positive blood culture, infants whose clinical course or lab data strongly suggest bacterial sepsis

**Attachment I – TBC Nutrition Guidelines**

1. **PURPOSE:**

This department guideline provides a consistent approach to nutrition therapy in the neonates born at a gestational age up until 24 6/7 weeks to achieve optimal nutrition.

1. **DEFINITIONS:**

When used in this department guideline, these terms have the following meanings:

BMP – Basic Metabolic Panel

DHM – Donor human milk/donor breast milk

DOL – Day of life

EN – Enteral nutrition

GIR – Glucose infusion rate

HMF HPCL - Similac® Human Milk Fortifier Hydrolyzed Protein Concentrated Liquid

MBM – Maternal breast milk

NPO – Nil per os (“nothing by mouth”)

PICC – Peripherally inserted central catheter

PIV – Peripheral intravenous line

Prolacta® – Prolact+ H2MF® Human Milk Fortifier

TPN/PN – Total parenteral nutrition/Parenteral nutrition

UAC – Umbilical arterial catheter

UVC – Umbilical venous catheter

1. **DEPARTMENT GUIDELINE:**
2. **Admission Fluids**
   1. NPO on admission
   2. Total fluids: 120 – 140 mL/kg/day
   3. Initiate dextrose containing fluids (i.e. Starter TPN) as soon as possible after delivery
   4. UVC fluids: TPN Neo Starter Dextrose 5%
   5. UAC fluids: TPN Neo Starter Dextrose 5% AND ¼ (0.225%) sodium acetate with 0.5 units/mL heparin for a total rate of 1 mL/hour.
      * 1. If ¼ sodium acetate not available, use TPN Neo Starter Dextrose 5% at 1 mL/hour
   6. If unable to obtain either a UAC or UVC, Y-site in both TPN Neo Starter Dextrose 5% and ¼ sodium acetate through one line
   7. An automatic nutrition consult is entered for Dietitian and Pharmacist to scribe PNs starting on DOL 3
3. **Parenteral Nutrition**
   1. Total Fluid Requirements
      * Initial (admission) fluids at 120 – 140 mL/kg/day
      * Advance by up to 20 mL/kg/day to a goal of 180 – 200\* mL/kg/day pending extreme electrolyte abnormalities

\*22 – 23 weekers may require > 200 mL/kg/day due to higher insensible losses

* 1. Dextrose
     + Dextrose should account for approximately 45-65% of caloric intake
     + Remember to consider peripheral vs central access and dextrose concentrations
  2. Peripheral line: ≤ 12.5%

|  |  |  |  |
| --- | --- | --- | --- |
|  | Initiation | Advance By | Goal |
| Dextrose (mg/kg/min) | 3 – 4 | 0.5 – 1 | 10 – 14 |

GIR = glucose infusion rate; GIR calculation (mg/kg/min) = [dextrose (g/d) x 1000] / [24 (h/d) x 60 (min/hour) x weight (kg)]

* + - Advance dextrose once blood glucose level has been stable (< 180 mg/dL) for 48 – 72 hours
    - In the presence of hyperglycemia - may decrease to a minimum GIR of 2 – 2.5 mg/dL and/or minimum dextrose concentration of 3%

\*For persistent hyperglycemia refer to the neonatal insulin guideline (Attachment K)

* 1. Amino Acids
     + Amino acids should account for approximately 10-20% of caloric intake
     + Initiate amino acids at 2 – 3 grams/kg/day and advance to a goal of 3.5 – 4 grams/kg/day over several days
     + In the presence of acute renal insufficiency, consider decreasing amino acids by 0.5 – 1 gram/kg/day
  2. Lipids
     + Lipids should account for approximately 20 – 30% of caloric intake
     + Initiate SMOF lipid® within 24 - 48 hours of life

|  |  |  |  |
| --- | --- | --- | --- |
|  | Initiation | Advance By | Goal |
| Lipid (gm/kg/day) | 1 | 0.5 – 1 | 3 |

* + - 1. If receiving SMOF lipid® for ≥ 4 weeks without concurrent enteral feeds, consider obtaining an essential fatty acid panel
    - In the presence of hyperglycemia – obtain plasma triglyceride level and adjust the dose of lipids based on plasma level:
      1. Acceptable range: ≤200 mg/dL
      2. Adjust lipids for TG >200 mg/dL

Ensure carnitine is added to PN: 10 mg/kg

|  |  |  |
| --- | --- | --- |
| Serum Triglyceride  (mg/dL) | Decrease Lipids By | Recheck Serum Triglycerides |
| 201 – 250 | 1 gm/kg/day | 24 hours |
| 251 – 300 | 1.5 gm/kg/day | 24 hours |
| > 300 | Discontinue lipids | 24 hours  When level < 200 mg/dL, restart lipids at 1 gm/kg/day and recheck level in 24 – 48 hours |

* 1. Electrolytes and Minerals
     + Monitor serum electrolytes closely within first few days of life

TBC admission order set includes daily Basic Metabolic Panel (BMP), Phosphorus, and Total Bilirubin (T. bili) for first 4 days of life

* + - Provide calcium within the first 24 hours of life
    - Phosphorus may be postponed 1 – 2 days based on serum level
    - Recommended electrolyte and mineral dosing:

Consider dosing/adjusting based on serum levels

|  |  |
| --- | --- |
| **Electrolyte/Mineral** | **Dosing** |
| Sodium | 2 – 5 mEq/kg |
| Potassium | 2 – 4 mEq/kg |
| Calcium\* ꝉ | 2 – 4 mEq/kg |
| Phosphorus\* | 1 – 2 mmol/kg |
| Magnesium | 0.3 – 0.5 mEq/kg |
| Acetate | As needed to maintain acid base balance |
| Chloride | As needed to maintain acid base balance |

\*use caution in prescribing calcium and phosphorus related to compatibility

ꝉ Maximum calcium in peripheral PN: 15mEq/L

The optimal calcium phosphorus ratio is 1.3-1.7:1 Ca:P

* 1. Multivitamins and Trace Elements
     + Multivitamins

|  |  |
| --- | --- |
| Weight (Kg) | Dose (mL) |
| < 1 | 1.25 |
| 1 – 3 | 3.25 |
| > 3 | 5 |

* + - Trace Elements
      1. 1 mL of Neo-Multitrace product currently available at Orlando Health provides the following dosing

1. Provide additional 200 mcg/kg/day of zinc

|  |  |
| --- | --- |
| Trace Element | Dose |
| Zinc | 200 mcg/kg |
| Copper | 20 mcg/kg |
| Manganese | 5 mcg/kg |
| Chromium | 0.2 mcg/kg |
| Selenium | 3 mcg/kg |

1. **Enteral Nutrition**
   1. Maternal breast milk (MBM) is the preferred diet. However, if MBM unavailable, donor human milk (DHM) should be used.
   2. Initiate oral care with colostrum once available
   3. Initiate trophic feeds on DOL 1 pending clinical stability and advance as described:

|  |  |  |
| --- | --- | --- |
| DOL | ≤ 23 6/7 weeks | 24 0/7 – 24 6/7 weeks |
| 1 | 1 mL Q6H | 1 mL Q3H |
| 2 | 1 mL Q3H | 1 mL Q3H |
| 3 | 1 mL Q3H | Advance by up to 20 mL/kg/day to goal |
| 4 | Advance by 1 mL daily to goal |  |

* 1. Advancing to goal feeds for the neonate born ≤ 23 6/7 weeks:
     + Advance feeds of breast milk to a goal of 100 mL/kg/day with no fortification
     + Hold feeds at 100 mL/kg/day until DOL 10; continue TPN/SMOF lipid® for the remaining total fluid volume ordered

If patient is > DOL 10 continue to advance until they reach 100 mL/kg/day

* + - If ≥ DOL 10 AND tolerating feeds at 100 mL/kg/day with renal function and electrolytes that are within normal limits:
      1. Initiate breast milk fortification with Prolacta®+6 diluted to make 24 Kcal/oz.
         * Order the Prolacta +6 and include the following statement in the diet order: “please mix Prolacta®+6 to make 24 Kcal/oz.”
      2. Advance feeds by 1 mL per day to goal and begin weaning off PN/SMOF lipid®
         * Aim to reach goal fortified feeds of 160 – 169 mL/kg/day by DOL 14 – 21
    - Once at goal feeds, if renal function and serum electrolytes within normal limits, may increase fortification to standard Prolacta®+6 to optimize nutrition and if necessary for weight gain.
    - Monitor electrolytes/minerals as appropriate
      1. Fortification can take up to 48 – 72 hours for electrolyte changes
      2. Obtain a serum BMP and Phosphorus levels no later than 48 hours from fortification
         * If phosphorus level is elevated, refer to the hyperphosphatemia section below
      3. Consider repeating electrolytes again in 2 – 4 days from previous levels
  1. Advancing to goal feeds for the neonate born 24 0/7 – 24 6/7 weeks:
     + Initiate breast milk fortification with Prolacta®+6 once feeds reach 80 – 100 mL/kg/day
     + Begin weaning off PN/SMOF lipid® as feeds are advanced
     + Monitor electrolytes/minerals as appropriate
       1. Fortification can take up to 48 - 72 hours for electrolyte changes
       2. Obtain a serum BMP and Phosphorus levels no later than 48 hours from fortification
          - If phosphorus level is elevated, refer to the hyperphosphatemia section below
       3. Consider repeating electrolytes again in 2 – 4 days from previous levels

1. Hyperphosphatemia on Prolacta® Fortifier:

|  |  |  |
| --- | --- | --- |
| **Serum Phosphorus (mg/dL)** | **Action** | **Repeat level** |
| < 8 | Continue fortifier | 48 hours |
| 8 – 9.9 | Dilute based on renal function:  Prolacta®+6 to make 24 Kcal/oz  OR  Prolacta®+8 to make 26 Kcal/oz  If already on diluted fortification: Discontinue fortifier | 24 – 48 hours |
| ≥ 10 | Discontinue fortifier | 24 hours  Consider restarting with diluted fortification when serum phosphorus level  < 8 mg/dL |

\* Prolacta ®+6 🡪 24 Kcal/oz: “please mix Prolacta®+6 to make 24 Kcal/oz”

\*\*Prolacta®+8 🡪 26 Kcal/oz: “please mix Prolacta®+8 to make 26 Kcal/oz”

1. Wean off Prolacta® fortification to Similac® HMF HPCL starting at 31 weeks postmenstrual age per guideline (GUID-1120-1890)
2. Wean off DHM support to preterm infant formula at 35 weeks postmenstrual age per guideline (GUID-1120-1890)
3. Important Considerations:

* Asphyxia, respiratory distress, sepsis, glucose disturbances, ventilation and umbilical lines are not contraindications for trophic feeds
* There is limited evidence to provide guidance on feeding practices during systemic arterial hypotension
* If on non-invasive ventilation, do not rely only on abdominal distension as a sign of feeding intolerance
* Do not check gastric residuals routinely, isolated green or yellow residuals are unimportant
* Consider withholding feeds in case of hemorrhagic residuals as it could be a sign of necrotizing enterocolitis
* Avoid continuous feeds as possible
* Do not routinely use glycerin suppositories to reduce the time to full enteral feeds

1. Vitamins and Minerals on Full Enteral Feeds AND DOL ≥ 14 (GUID-1120-1694):
   1. Vitamin D: 400 IU once daily
   2. Multivitamins with iron:

|  |  |  |
| --- | --- | --- |
| Weight (Kg) | Daily Dose (mL) | Iron Dose (mg/kg) |
| < 1 | 0.2 | 2 – 4 |
| 1 – 1.5 | 0.3 | 2 – 3 |
| 1.5 – 2 | 0.4 | 2 – 3 |
| 2 – 2.2 | 0.5 | 2 – 3 |
| > 2.2 | 1 | < 5 |

1. IV Access
   1. UAC and UVC to be inserted during admission
   2. UAC is generally utilized for 5 -7 days
      * If blood draws are minimal and blood pressure/hemodynamic status are stable
      * UAC can be continued for > 7 days pending extreme circumstances (i.e. hypotension requiring vasopressor/inotropic support, intense blood glucose monitoring and treatment, frequent lab draws, lack of alternative intravenous access)
   3. UVC is generally utilized for 7 – 10 days, pending IV access
      * Consider obtaining a PICC line between DOL 5 - 7
      * Consider a PICC or PIV based on nutritional needs and hemodynamic status

For 22 & 23 week gestational age neonates – PICC line is highly recommended

* 1. Maintain umbilical lines if no other line access is available
  2. Add heparin to all central line fluids and PN
     + < 1kg: 0.5 units/mL
     + ≥ 1 kg: 1 units/mL

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**Attachment J – PRBC Guidelines for TBC**

1. **Overview:**
2. In 22-24 week infants, transfusion should be considered if increased oxygen delivery to tissues is needed based upon the clinical status of the patient.
   1. Acute Blood Loss:

Acute red blood cell transfusions should generally only be considered in the setting of acute blood volume loss of 10% with symptoms of decreased oxygen delivery or when acute blood volume loss is > 20%.

* 1. Chronic Blood Loss:

|  |  |
| --- | --- |
| **BLOOD TRANSFUSION** | |
| **Hb Level** | **Consideration** |
| <11.5 | Ventilated with >60% O2 |
| <10 | Ventilated  CPAP > 50% O2 |
| <8 | CPAP < 50% OR NC 100%;  RA but symptomatic |

|  |  |
| --- | --- |
| **BLOOD PRODUCTS** | |
| Cryo | 10 ml/kg IV over 1h (fibrinogen <100) |
| FFP | 10-15 ml/kg IV over 1h (PT> 20, PTT >100) |
| pRBC | 15-20 ml/kg over 4 hours |
| Platelets | 15-20 ml/kg IV over 1-2hours |

Indications for transfusion for infants with chronic blood loss is based on target hematocrit/hemoglobin levels that are dependent on the infant's need for respiratory support and age.

* 1. For infants requiring moderate or significant mechanical ventilation, defined as mean airway pressure (MAP) >8 cm H2O and Fi02 >0.60 on ventilator transfuse if hemoglobin <11.5 g/dL.
  2. For infants requiring minimal mechanical ventilation or use of CPAP and FIO2 > 0.5 transfuse if hemoglobin < 10 g/dL.
  3. For infants on supplemental oxygen who are not requiring mechanical ventilation, transfusions can be considered if the hemoglobin <8 g/dL and one or more of the following conditions is present:
     + - 1. Tachycardia (heart rate >180 beats per minute)
         2. If the infant will undergo major surgery within 72 hours
         3. Doubling of the oxygen requirement from the previous 48 hours
  4. For infants without any symptoms, transfusions can be considered if the hemoglobin <7g/dL associated with an absolute reticulocyte count (<2%).

1. General Guidelines:
   1. Delayed Cord Clamping (60 seconds ideally).
   2. Obtain neonatal blood type and blood culture from cord blood.
   3. In-LINE line blood sampling.
   4. Use of EPOC/POCT (VIA In-Line Analyzer) when possible
   5. Order blood work judiciously.
2. Blood Ordering/Administration:
   1. Blood ordered: Packed Red Blood Cells (PRBCs): always leukoreduced, irradiated, and washed if less than 1000 grams and less than 1 week old. CMV negative is preferred.
   2. For the majority of blood transfusions, patient will be made NPO and remain that way until post transfusion.
   3. In some cases, and per physician discretion, patient may continue on trophic feeds during transfusion.
   4. For infants with only one point of IV access, it is at the managing Physician’s discretion whether to give IV fluids simultaneously with blood.
   5. Feeds to be restarted per physician’s discretion.
3. Platelet Guidelines:

|  |  |
| --- | --- |
| **TBC PLATELETS GUIDELINE** | |
| Platelet Count (x 109/L) | Consideration |
| <30 | At all times |
| 30-49 | Within 72 hours of life  Previous significant hemorrhage (i.e. grade 3 or 4 IVH)  Coagulopathic  Prior to surgical procedure  Post op 72 hours  Unstable with use of pressors |
| 50-99 | Active bleeding  Before and after neurosurgical procedures |

**References:**

1. AABB Standards for Blood Banks and Transfusion Services. 29th Edition. 2014
2. AABB Standards for Blood Banks and Transfusion Services, 29th edition.
3. Fanaroff and Martins Neonatal –Perinatal Medicine. 10th Edition, 2015.

**Attachment K – TBC Insulin Protocol**

1. **Definition:** Serum glucose > 180mg/dL
2. **Rationale:** Hyperglycemia is common in Extremely Low Birth Weight (ELBW) with the incidence being inversely proportional to birthweight (~60% in ELBWs and ~ 80% in patients < 750 grams)
   * + 1. Hyperglycemia in this population is due to:
3. Increased levels of endogenous stress hormones
4. Insulin resistance
5. Parental nutrition
6. Medications such as steroids
7. Sepsis
   * + 1. Complications of hyperglycemia:
8. Polyuria leading to significant weight loss, dehydration and electrolyte imbalances
9. Increased risk of CNS ischemia and stroke, Intraventricular hemorrhage and death
   * + 1. Insulin recommendations:
          1. Target serum glucose level while on insulin 180-250 mg/dL
   1. Prior to initiation of treatment with insulin consider:
10. Decreasing glucose infusion rate (GIR) to a minimum maintenance of 2.5 mg/kg/min
11. Investigating other potential causes of hyperglycemia, such as bacterial and fungal infections, steroid use, and hypertriglyceridemia
    1. Criteria for use of insulin:
12. Serum glucose levels > 250 mg/dL x 2 consecutively despite:
    * Corrected for pseudohyponatremia
    * Reduction in GIR to a minimum of 2.5 mg/kg/min
    1. Desired standard concentration is 0.05 units/mL (available in orders)
    2. Initiate with:

Bolus: Regular Insulin 0.05 units/kg/dose IV. May attempt 3 boluses in 12 – 24 hours before initiating a continuous drip (spaced by at least 3 hours in between boluses)

Continuous Infusion: Start Regular insulin at 0.05 units/kg/hr IV

* 1. Insulin drip dosing recommendations for **increasing** glucose levels

|  |  |
| --- | --- |
| **Glucose level (mg/dL)** | **Increase dose (units/kg/hr) by**  **(from your current drip dose)** |
| 180 – 250 | Continue current dose |
| 250 – 300 | 0.01 |
| 301 – 350 | 0.01 |
| 351 – 400 | 0.02 |
| 400 – 450 | 0.02 |
| > 450 | 0.03 |
| Persistently increasing glucose levels AND Increased drip dose x 3 times in a row | Bolus: 0.05units/kg/dose IV  +  Increase drip dose  based on most recent glucose level  +  Notify medical team |

Monitoring:

1. Check glucose level 1 hour after initiating drip
2. Check glucose level 1 hour after making any dose adjustment/intervention
3. If glucose level is within target range (180 – 250 mg/dL) x 2 times consecutively AND not decreasing by > 50 mg/dL, then space glucose checks out to every 2 hours
4. If glucose level is within target range (180 – 250 mg/dL) with no changes to the drip rate for 12 – 24 hours, then space glucose checks out to every 3 - 6 hours.
   1. Insulin drip dosing recommendations for **decreasing** glucose levels

|  |  |
| --- | --- |
| **Glucose level decreases**  **by (mg/dL)** | **Decrease dose (units/kg/hr) BY**  **(from your current drip dose)** |
| > 100 | 0.03 + notify medical team |
| 76 – 100 | 0.02 + notify medical team |
| 50 – 75 | 0.01 + notify medical team |
| Level between 140 – 180 | Decrease dose by 50% |
| Level < 140 | STOP the drip |

Monitoring:

1. Check glucose level 1 hour after a dose decrease
2. Continue to check glucose level every 1 hour until target range (180 – 250mg/dL) AND not decreasing by > 50 mg/dL, then space glucose checks out to every 2 hours
3. If glucose level is within target range (180 – 250 mg/dL) with no changes to the drip rate for 12 – 24 hours, then space glucose checks out to every 3 - 6 hours.
   1. Discontinuation of the drip - Monitoring
4. Check glucose level every 1 hour x 3 times after discontinuation of insulin drip, if stable then,
5. Every 2 hours x 3 consecutive times, if stable then,
6. Every 6 hours for the following 24 hours
   1. Insulin Tubing Changes
7. Insulin binds to the IV tubing and therefore the tubing should be primed and not changed more often, or the dose may vary
   * Insulin tubing is to be changed every 96 hours
8. Insulin syringes will continue to be changed every 24 hours
9. Procedure for Priming IV Tubing (prior to initiation and with every tube change)

* Prime the IV tubing with insulin from the insulin drip syringe
* Leave the tubing with insulin to dwell for at least 20 minutes
* After dwelling for at least 20 minutes, waste the dwell volume in the IV tubing
* Re-prime IV tubing with insulin from the insulin drip syringe prior to administration
  1. Special considerations

1. Administer via a dedicated line that will not either be flushed or have other medications as this will result in a bolus of insulin
2. Consider switching to continuous feeds if blood glucose level remains labile

**References:**

1. Ramel S, Rao R. Hyperglycemia in Extremely Premature Infants. *NeoReviews* 2020;21;e89.

**Attachment L – Medications (Postmenstrual Age < 29 weeks)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Antibiotics** | | **Post Natal Age**  **≤ 28 days** | **Post Natal Age**  **> 28 days** |
| Acyclovir | 20 mg/kg/dose IV | Every 8 hours | |
| Amphotericin (Liposomal) | 3 mg/kg/dose IV | Every 24 hours | |
| Amphotericin (Conventional) | 1 mg/kg/dose IV | Every 24 hours | |
| Ampicillin | 100 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Ampicillin - Sulbactam | 100 mg/kg/dose IV | Every 12 hours | |
| Cefazolin | 25 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Cefepime | 30 mg/kg/dose IV (≤28d)  50 mg/kg/dose IV (>28d)  Meningitis: 50 mg/kg/dose IV | Every 12 hours | |
| Ceftazidime | 30 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Gentamicin  \*If duration > 48 hours consult pharmacy | 5 mg/kg/dose IV | Every 36 hours | |
| Metronidazole | Loading: 15 mg/kg x 1 dose IV  Maintenance: 7.5 – 10 mg/kg/dose IV | Every 24 hours | |
| Nafcillin | 25 mg/kg/dose IV  50 mg/kg/dose IV (Meningitis) | Every 12 hours | Every 8 hours |
| Piperacillin-Tazobactam (Zosyn) | 100 mg/kg/dose IV | Every 12 hours | Every 8 hours |
|  |  | **Post Natal Age**  **≤ 14 days** | **Post Natal Age**  **> 14 days** |
| Fluconazole  (PICC Prophylaxis) | 3 mg/kg/dose IV | Twice weekly on Monday, Thursday | |
| Fluconazole  (Invasive Candidiasis) | Loading: 25 mg/kg x 1 dose IV  Maintenance: 12 mg/kg/dose IV | Every 48 hours | Every 24 hours |
| Meropenem | 20 mg/kg/dose IV  40 mg/kg/dose IV (Meningitis) | Every 12 hours | Every 8 hours |
| Vancomycin  \*If duration > 48 hours consult pharmacy | 15 mg/kg/dose IV | Every 18 hours | Every 12 hours |

|  |  |
| --- | --- |
| **Analgesic/Sedation** | |
| Acetaminophen (IV) | 10 mg/kg/dose every 12 hours |
| Acetaminophen (PO) | 10mg/kg/dose every 8 hours |
| Dexmedetomidine | 0.2 – 2 mcg/kg/hr |
| Morphine | 0.05 – 0.1 mg/kg/dose  every 2 - 4h PRN |
| Midazolam | 0.05 – 0.1 mg/kg/dose  every 2 - 4h PRN |
| Vecuronium | 0.1 mg/kg/dose |

|  |  |
| --- | --- |
| **Cardiac** | |
| Dobutamine | 2 – 20 mcg/kg/min |
| Dopamine | 2 – 20 mcg/kg/min |
| Epinephrine | 0.1 – 1 mcg/kg/min |
| Hydrocortisone  (IV/PO) | 0.5 – 1 mg/kg/dose  every 8 – 12 hours |
| Milrinone | 0.25 – 0.75 mcg/kg/min |
| Prostaglandin E1 | 0.01 – 0.1 mcg/kg/min |
| Sildenafil (PO) | 1 mg/kg/dose every 8 hours |
| Sildenafil (IV) | 0.5 mg/kg/dose every 8 hours |
| Vasopressin | 0.01 – 0.04 units/kg/hr |

|  |  |
| --- | --- |
| **Respiratory** | |
| Caffeine (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 10 mg/kg/dose every 24 hours |
| Chlorothiazide | 10 – 20 mg/kg/dose every 12 hours |
| Furosemide (IV) | 1 mg/kg/dose every 24 hours |
| Furosemide (PO) | 2 mg/kg/dose every 24 hours |
| Curosurf | 2.5 ml/kg Intratracheal x 1 dose  1.25 ml/kg for repeated dose |
| Vitamin A | 5,000 units/dose IM every M,W,F |

|  |  |
| --- | --- |
| **Other** | |
| Levetiracetam (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 10 mg/kg/dose every 12 hours |
| Phenobarbital (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 3 -5 mg/kg/day divided every 12 hours (started 12 hours after Loading dose) |
| Ursodiol | 10 – 15 mg/kg/dose every 12 hours |
| Glycerin LIQUID rectal suppository | 1ml/dose |

**Attachment M – NICU NEC Pathway**

Initial infectious workup recommendations:

1. Blood culture prior to antibiotics

*Antibiotics may need to be tailored according to blood culture growth*

|  |  |  |  |
| --- | --- | --- | --- |
| *Empiric Antimicrobial Selection and Duration for NEC*  **Modified Bell’s Criteria** – to be assessed by the NICU attending | ≤ 7 days of life | > 7 days of life | Duration of therapy (days) |
| **1 a/b**  Clinically suspected  Blood in stool  Apnea and bradycardia  Lethargy | Ampicillin and gentamicin | Ampicillin and gentamicin | 3 |
| **2 a**  Dilation/Ileus  Pneumatosis  Abdominal Tenderness | Ampicillin and gentamicin | Zosyn | 7 |
| **2 b**  Portal venous gas  Ascites  Thrombocytopenia  Metabolic acidosis | Ampicillin and gentamicin | Zosyn | 10 |
| **3 a/b**  Hemodynamic compromise  Resp/metabolic acidosis  DIC  Neutropenia  Pneumoperitoneum | Ampicillin and gentamicin | Vancomycin and Zosyn | 10 |

1. Peritoneal culture if surgical management required

**References:**

1. Walsh M & Kliegman R. Necrotizing enterocolitis: treatment based on staging criteria. *Pediatr Clin North Am*. 1986;33:179-201.
2. Cantey J. Optimizing the use of antibacterial agents in the neonatal period. *Pediatr Drugs*. 2016;18.109-122.
3. Coggins S, Wynn J, & Weitkamp J. Infectious causes of necrotizing enterocoloitis. *Clin Perinatol*. 2015;42:133-154.
4. Shah D & Sinn J. Antibiotic regimens for the empirical treatment of newborn infants with necrotizing enterocolitis. *Cochrane Database Sys Rev*. 2012.
5. Lim J, Golden J, & Ford H. Pathogenesis of neonatal necrotizing entercolitis. *Pediatr Sug Int*. 2015;21:509-518.
6. Rich BS & Dolgin SE. Necrotizing Enterocolitis. *Peds in Rev*. 2017;38:552-559.
7. Brook. Microbiology and Management of Neonatal Necrotizing Enterocolitis. *Am J Perinatol*. 2008;25(2):111-118.

**Attachment N – NICU Bedside Surgical Procedures**

1. Consult placed to the Pediatric General Surgery team with concern for SIP or NEC (stage 2a or more)
2. Neonatology/Pediatric General Surgery team evaluates for:
   1. Neo R/o Intestinal Perforation Order Set:
      1. STAT 2 View Abdominal X-ray Anterior Posterior/Left lateral decubitus reviewed for presence or absence of:
         1. Dilated bowel
         2. Pneumoperitoneum
         3. Pneumatosis intestinalis
         4. Portal venous air
         5. Ileus
         6. Persistent fixed dilated loop of bowel
      2. STAT LIMITED ABDOMINAL Ultrasound r/o Intestinal perforation assess for:
         1. echogenic free fluid
         2. portal venous air
         3. free air
         4. peristalsis
         5. pneumatosis
         6. phlegmon
   2. Laboratory results reviewed for presence of:
      1. Metabolic or respiratory acidosis
      2. Thrombocytopenia
      3. Anemia
      4. Hypo or hyperkalemia
      5. Clotting factors
      6. Positive blood culture
   3. Physical Assessment observe for:
      1. What day of life patient on (usually 7-21 days of life)
      2. Increased respiratory support
      3. Hemodynamics (bradycardia events)
      4. Hypotension
      5. Distended abdomen
      6. Abdominal wall discoloration (purple/blue versus red/erythematous)
      7. Urine output
      8. Sepsis
   4. Social
      1. Parents understanding of condition
      2. Parental willingness to move forward with intervention
      3. Presence of confounding clinical factors (i.e. IVH, PDA, and abnormal chromosomes)
3. Based on the results of the above gathered information the determination will be made jointly between Neonatology, family and Surgery on how to proceed.

The 3 treatment options include:

1. No surgical intervention
2. Bedside Penrose drain (if patient is too unstable to undergo full laparotomy) serial reassessment will occur to determine if there is a need for further intervention
3. Bedside exploratory laparotomy, if stable per surgeon discretion

It is important to note there is no gestational age or weight cut off for this procedure. Rather the above clinical factors that determine best approach to individual patient treatment.

\*This guideline is a general decision tree pathway. Actual patient care may deviate depending on patient specific needs.

**References:**

1. Fischer A, Vachon L, & Cayabyab RG. Ultrasound to diagnose spontaneous intestinal perforation in infants weighing < < 1000 grams at birth. Journal of Perinatology. 2015;35:104-109.
2. Cuna A, Reddy N, Robinson A, & Chan S. Bowel Ultrasound for predicting surgical management of necrotizing enterocolitis: a systemic review and meta-analysis. Pediatric Radiology. 2018;48:658-666.

**Attachment O: Bedside Exploratory Laparotomy**

**Procedure Treatment Guideline**

1. **PURPOSE:**

The Purpose of this process is to delineate actions required when performing bedside laparotomy procedures in the Neonatal Intensive Care Unit.

1. **DEFINITIONS:**

None

1. **DEPARTMENT PROCESS:**
   1. Discussion to occur during consultation then will move patient if deemed appropriate for performing bedside exploratory laparotomy. Generally, infants will have a bedside laparotomy if they are stable enough. A patient experiencing severe decompensation such as inability to ventilate or needing increasing vasopressors to maintain blood pressure will have drains at the bedside first.
   2. Equipment:
      * Bovie machine and grounding pad of appropriate size
      * Operating Room/surgery cart/tray
      * Chemical mattress
      * Anesthesia medication cart
      * Betadine prep cart
      * Fiber optic head light
      * Other surgical lighting as requested by the surgeon
      * Surgical table
      * Sterile gowns, hats, masks, gloves, door signs “Procedure in Process – DO NOT ENTER”
      * Eye protection
      * Emergency blood in the nearest blood refrigerator
      * **Two (2)** IV bag warmers (such as “bird bath”) with one bag (250 ml) for surgical team and another for anesthesia (OR team to bring over)
   3. Surgical team to notify OR team and post on SIS (official surgery schedule). Notify OR Charge as soon as there is consideration for procedure to ensure proper staffing is available.
   4. NICU team to order “premie pack” (20cc/kg), and notify Grand Station secretary regarding STAT order. Products to be washed (24 hour expiration). Blood to be stored in the NICU fridge.
   5. RN in NICU to notify NICU Level 3 charge nurse, lead respiratory therapist and bedside respiratory therapist.
      * NICU charge nurse and respiratory therapist to coordinate moving patient to ECMO room. Move boom to the patient’s right side (surgeon’s side)
      * Increase room temperature to approximately 80 degrees.
      * Ensure patient is in an Omnibed.
        + 1. Please move IV pumps to patient’s head and left side of bed
          2. Remove IV pump shelf to allow for more room around bed for OR team
      * Scrub nurse will perform pre-operative scrub at sinks in NICU and begin sterile set up of supplies and instruments on surgical table.

**See addendum B for OR scrub and circulator responsibilities**

* + - Bedside nurse and respiratory therapist will prepare the patient:
      1. Ensure access to IVs or lines on the patient’s left side and head of bed
         * If patient has PICC line place, provide extra PIV for anesthesia to use if possible (or Medline from PICC if PIV attempts fail).
         * Try to start a PIV for anesthesia to use during the procedure and to administer blood products if necessary.
         * If there is a separate PIV, prepare tubing with a Luer-lock t-connector, then a medication line tubing and then a stopcock on the end of the med line farthest from the patient.
         * If you only have a central line such as umbilical line or PICC line, put a stopcock on the end of the med line farthest from the patient.
      2. Discuss with neonatologist pre-medicating the patient with Versed and/or Morphine before teams start arriving for the procedure.
      3. Ensure ET tube well secured, suction is ready and available for procedure. (Neobar is acceptable). Ventilator should be to the left side of patient.
      4. Allow for maximal space within the patient room (including slight movement of neighboring patient)
      5. Double check chest rise and ET tube position after positioning the patient to ensure adequate ventilator support.
      6. Secure new **temperature probe** to lateral axilla
      7. Change omnibed heater off when thermal mattress activated
      8. Turn off SMOF lipids if running through same medication line, may ask anesthesia if question/concern
      9. Gather all equipment and place left side of patient
      10. Place surgical thermoregulation hat on patient
      11. Remove renal Invos for procedure if in place
      12. NICU RN - Lift patient at one time to place an extra layer of blankets, then the chemical mattress, then place OR special chux pad on top of mattress, while Bovie grounding pad is secured to patient.
          * Ensure grounding pad in proper placement - **small** Bovie pad for patient (save package for OR scrub, they need lot #)
          * The grounding pad should be placed on the patient’s back (avoid skin folds, areas with erythema or rash, long bone and pressure point areas, and lean tissue areas)
          * Activate by kneading chemical mattress
          * Turn off other external heating sources while mattress in use
          * Then place OR chux pad next to patient and on top of chemical mattress
          * Place patient in supine position
          * Keep the grounding pad dry
          * Eliminate patient contact with metal objects.
          * Assure no free flow oxygen is under the surgical drape where the cautery will be used.
          * Set usual Bovie settings of:

Blend One

Cut Power of 12

Coag Power of 10

* + - * + Bedside RN and RT should stay close to anesthesia team to answer questions and assist with equipment and supplies as needed.
    - All personnel in the area or room should wear caps and masks appropriately while caring for the infant during procedure.
    - Zero syringe pumps for OR fluid calculations.
    - When surgeon is ready and hands the end of the Bovie pencil to the person acting as the coordinator, connect to the area on the Bovie machine that says “hand switch” and stand by in case the surgeon wants the settings adjusted.
    - Ensure only necessary personnel are present in room (surgeons, anesthesiologist, surgery Advanced Practice Provider (APP) and/or resident, CRNA, OR scrub tech, OR circulating nurse) in the back of the room outside the surgical space should be the bedside RN and RT.
    - NICU provider (if available) and charge nurse stand at the entrance of the room. Door to remain CLOSED.
  1. Brief summary provided by neonatologist/neonatology team.
  2. TIME OUT AND REVIEW OF CONSENT PERFORMED BY OR RN
  3. Induction of Anesthesia
     + Anesthesia to monitor patient vital signs and fluids.
     + Anesthesia to administer medication from head of bed.
     + NICU nurse should be documenting fluids.
  4. Intra-Operative Scrub Nurse
     + Gown and glove surgeons.
     + Assist surgeon in draping patient.
     + Make available instruments and supplies needed.
     + Assist with restocking of supplies and breakdown of equipment after procedure. Take surgical instruments to sterile processing in approved container.
  5. Respiratory Therapist Duties
     + Assist anesthesia to ensure a patent and secure airway during procedure and stand by for emergency respiratory support and intervention.
     + Assist with management of ventilator if needed.
  6. At conclusion of procedure:
     + Close top of Omnibed as soon as possible.
     + Turn warmer heat back on
     + Remove chemical mattress and first layer of chux pads. Ensure patient lying on dry surface.
     + Leave hat on, consider adding plastic blanket until normothermic for 1 hour.
     + Monitor vital signs in accordance with optimal surgical management protocol.
     + Multi-disciplinary Debrief/Hand-off and Review of case, including a review of antibiotic plans. Nursing to fill out postop SBAR.

1. **DOCUMENTATION:**
   1. Universal protocol will be documented in Sunrise for each surgical procedure by OR nurse.
   2. OR nurse to document in SIS.
   3. Anesthesia will maintain their OR record and place in chart.
   4. Post op vital signs according to NICU optimal surgical management protocol.
2. **PRECAUTIONS:**
   1. Notify neonatology immediately of any unacceptable ABG or of any emergency scenario such as Code Status.
   2. Specify which blood products would be required to be present or on standby, if any.

**Addendum A**

**RN Charge Bedside Procedure Coordinator Checkoff List**

|  |  |
| --- | --- |
| Notification | |
|  | Surgeons |
|  | OR Team |
|  | RT Lead |
|  | Blood Ordered as Requested |
| Preparations | |
|  | Ensure Patient in Omnibed |
|  | Move extra unnecessary equipment out of room to Make Room for OR Process, Ensure ventilator equipment and pumps are on the patient’s left side of bed |
|  | Ensure suction is set up and adequate for OR team |
|  | Place OR Table, Head Light and Cautery in Room |
|  | Assist RN in filling out SBAR sheet, assess consent packet complete, help place Bovie pad on back |
|  | Obtain Chemical Warming Mattress and chux pad, activate and place under patient just prior to patient prep, turn off other sources of heat |
|  | Place Chux pad down first, then position patient on Top of Mattress as Requested |
|  | Verify Blood Availability |
|  | Assist Bedside RN in establishing PIV if patient has PICC or medline if no PIV obtainable, Assist in Zeroing Fluids in Pumps Just Prior to Start of Procedure |
|  | Notify Neonatologist to be in Room When OR Team Ready |
|  | Participate in Time Out |
|  | Keep Room Quiet During Procedure and room doors closed |
|  | Be Available to Assist When Necessary |
|  | RN to Keep Track of Fluids and Blood Given During OR |

**Addendum B**

**OR Scrub and Circulator Responsibilities**

* Circulator and scrub will bring NICU cart, fluid warmer, Normal Saline & Thrombin to NICU
* Circulator and scrub will open supplies onto table
* Circulator, RN, & Anesthesia will perform Bedside Time Out
* Circulator will check consents
* Circulator will document OR in time after the above Time Out
* Circulator will obtain Bovie pad lot # from bedside RN and do skin prep
* When scrub is ready, scrub and circulator will do sharp/sponge count
* Circulator will document and charge supplies on down time forms
* Circulator will do Time Out when Surgeon calls for Time out
* Circulator will be responsible for all specimens and documentation
* Circulator and scrub will perform counts as needed and alert surgeon of result
* Scrub and circulator will be responsible to clean infant, dressing application, & remove Bovie pad
* Circulator will document OR end time after anesthesia hands off infant to NICU RN
* Circulator and scrub will be responsible to clean area of used supplies, wipe down table, Bovie, and head light
* Scrub will be responsible to spray and place use instruments in biohazard bag and return to SPD
* Circulator will be responsible to return NICU cart with unused supplies and fluid warmer to OR
* Circulator will document surgery in SIS and any specimens in Sunrise
* Circulator will send specimen to Pathology according to Surgeon order
* Scrub and circulator will be responsible for restocking NICU surgical cart

**Attachment P – Hydrocephalus Treatment Guideline**

Consult placed to the Pediatric Neurosurgery team for ventriculomegaly from any cause

Neo/Pediatric Neurosurgery team evaluates for:

* 1. Radiologic studies reviewed for presence or absence of:
     1. Ventricular size and etiology of hydrocephalus: based on Head ultrasound and /or Flash brain MRI
     2. IVH
     3. Other congenital anomalies
  2. Laboratory results reviewed presence of:
     1. Thrombocytopenia
     2. Anemia
     3. Hypo or hypernatremia
     4. Clotting factors
     5. Positive Cerebral Spinal Fluid (CSF) cultures from Lumbar Puncture (LP) or ventricular tap
     6. Positive Blood cultures
  3. Physical Assessment observe for:
     1. Hemodynamics: Apnea or bradycardia events
     2. Anterior Fontanelle fullness or splaying of cranial sutures
     3. Serial head circumference monitoring
     4. Lethargy
     5. Signs of increased intracranial pressure
  4. Social
     1. Parental education about condition
     2. Parental willingness to move forward with intervention
     3. Presence of confounding clinical factors (i.e. IVH, PDA, and abnormal chromosomes)

Based on the results of the above gathered information the determination will be made jointly between Neonatology and Neurosurgery on how to proceed.

Progression of treatment options including:

1. Ventricular taps an option, some infants will go directly to ETV or shunt
2. Insertion of tapping reservoir (bedside or APH OR) -weight approximately 1kg
3. External Third Ventriculostomy, ETV with Choroid Plexus Coagulation, or Insertion of Ventriculoperitoneal shunt - weight approximately 2 kg
4. Home without surgical intervention

\*This guideline is a general decision tree pathway. Actual patient care may deviate depending on patient specific needs.

**References:**

1. Pediatric hydrocephalus: systematic literature review and evidence-based guidelines. Part 2: Management of posthemorrhagic hydrocephalus in premature infants. Mazzola CA, Choudhri AF, Auguste KI, Limbrick DD Jr, Rogido M, Mitchell L, Flannery. J Neurosurg Pediatr. 2014 Nov;14 Suppl 1:8-23.
2. Endoscopic third ventriculostomy and choroid plexus cauterization with a rigid neuroendoscope in infants with hydrocephalus. Weil AG, Fallah A, Chamiraju P, Ragheb J, Bhatia S., Neurosurg Pediatr. 2015 Oct.

**Attachment Q – Tiny Baby Patent Ductus Arteriosus (PDA)**

1. It has been well established that in premature neonates, PDA closure is delayed. In extremely premature neonates, this process can be prolonged. Furthermore, delayed PDA closure can lead to hemodynamic changes in the heart, lungs, and circulatory system that have been linked to common morbidities associated with preterm birth including bronchopulmonary dysplasia (BPD), intraventricular hemorrhage, and necrotizing enterocolitis.
2. The purpose of the PDA management pathway (PDA-MPW), as a quality improvement project, was to standardize the identification and management of a hemodynamically significant PDA in preterm neonates.
   1. The pathway was based on review of existing literature regarding hemodynamically significant PDA diagnosis and management, as well as a review of our institutional experience with transcatheter PDA (TC-PDA) occlusion.
   2. In an effort to reserve TC-PDA for those neonates at highest-risk for PDA-associated morbidity, the PDA-MPW (see addendum below) integrates a validated tool to assess BPD risk (NICHD BPD risk calculator).
      1. Inclusion criteria for the pathway included gestational age < 30 weeks and bronchopulmonary dysplasia (BPD) composite risk > 40%.
      2. Using parameters based on transthoracic echocardiographic findings as well as additional clinical markers, a score was created to advise management.
   3. The treatment options included supportive care and/or referral for transcatheter PDA occlusion (TC-PDA).
3. Tiny baby collaborative PDA considerations:
   1. Initial screening echocardiogram maybe delayed due to patient’s weight (must be >700grams)
   2. Echo may be delayed due to patients hemodynamical instability
   3. Occlusion maybe deemed not indicated, postponed or delayed according to the TBC team’s judgement

**Addendum A**

**Diagram, schematic

Description automatically generated**

**References**

1. Semberova J, Sirc J, Miletin J, Jucera J, Berka I, Sylva S, et al. Spontaneous closure of patent ductus arteriosus in infants < 1500 g. Pediatrics 2017;140:e20164258.
2. Sehgal A and McNamara. International perspective on management of patent ductus arteriosus: lessons learned. Seminars in Fetal and Neonatal Medicine 2018;23:278-284.
3. Zahn E, Nevin P, Simmons C, Garg R. A novel technique for transcatheter patent ductus arteriosus closure in extremely preterm infants using commercially available technology. Catheter and Cardiovascular Interventions 2015;85:240-248.
4. Sathanandam S, Justino H, Waller R, Radtke W, Qureshi A. Initial clinical experience with the medtronic micro vascular plug in transcatheter occlusion of PDAs in extremely premature infants. Catheter and Cardiovascular Interventions 2017;89:1051-1058.

**Attachment R – TBC Reference Cards**

|  |  |  |  |
| --- | --- | --- | --- |
| **Antibiotics** | | **Post Menstrual Age ≤ 29 weeks** | |
| **Post Natal Age ≤ 28 days** | **Post Natal Age > 28 days** |
| Acyclovir | 20 mg/kg/dose IV | Every 8 hours | |
| Amphotericin (Liposomal) | 3 mg/kg/dose IV | Every 24 hours | |
| Amphotericin (Conventional) | 1 mg/kg/dose IV | Every 24 hours | |
| Ampicillin | 100 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Ampicillin – Sulbactam | 100 mg/kg/dose IV | Every 12 hours | |
| Cefazolin | 25 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Cefepime | 30 mg/kg/dose IV (≤28d)  50 mg/kg/dose IV (>28d)  Meningitis: 50 mg/kg/dose IV | Every 12 hours | |
| Ceftazidime | 30 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Gentamicin  \*monitor trough If duration > 48 hours | 5 mg/kg/dose IV | Every 36 hours | |
| Metronidazole | Loading: 15 mg/kg x 1 dose IV  Maintenance: 7.5 – 10 mg/kg/dose IV | Every 24 hours | |
| Nafcillin | 25 mg/kg/dose IV  Meningitis: 50 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Piperacillin-Tazobactam (Zosyn) | 100 mg/kg/dose IV | Every 12 hours | Every 8 hours |
|  |  | **Post Natal Age ≤ 14 days** | **Post Natal Age > 14 days** |
| Fluconazole  (PICC Prophylaxis) | 3 mg/kg/dose IV | Twice weekly on Monday, Thursday | |
| Fluconazole  (Invasive Candidiasis) | Loading: 25 mg/kg x 1 dose IV  Maintenance: 12 mg/kg/dose IV | Every 48 hours | Every 24 hours |
| Meropenem | 20 mg/kg/dose IV  Meningitis: 40 mg/kg/dose IV | Every 12 hours | Every 8 hours |
| Vancomycin  \*If duration > 48 hours consult pharmacy | 15 mg/kg/dose IV | Every 18 hours | Every 12 hours |

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| **Cardiac** | | **Respiratory** | |
| Dobutamine | 2 – 20 mcg/kg/min | Caffeine (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 10 mg/kg/dose every 24 hours |
| Dopamine | 2 – 20 mcg/kg/min | Chlorothiazide | 10 – 20 mg/kg/dose every 12 hours |
| Epinephrine | 0.1 – 1 mcg/kg/min | Furosemide (IV) | 1 mg/kg/dose every 24 hours |
| Hydrocortisone  (IV/PO) | 0.5 – 1 mg/kg/dose  every 8 – 12 hours | Furosemide (PO) | 2 mg/kg/dose every 24 hours |
| Milrinone | 0.25 – 0.75 mcg/kg/min | Curosurf | 2.5 ml/kg Intratracheal x 1 dose  1.25 ml/kg for repeated dose |
| Prostaglandin E1 | 0.01 – 0.1 mcg/kg/min | Vitamin A | 5,000 units/dose IM every M,W,F |
| Sildenafil (PO) | 1 mg/kg/dose every 8 hours | **OTHER** | |
| Sildenafil (IV) | 0.5 mg/kg/dose every 8 hours | Levetiracetam  (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 10 mg/kg/dose every 12 hours |
| Vasopressin | 0.01 – 0.04 units/kg/hr | Phenobarbital  (IV/PO) | Loading: 20 mg/kg x 1 dose  Maintenance: 3 -5 mg/kg/day divided every 12 hours (started 12 hours after Loading dose) |
|  |  | Ursodiol | 10 – 15 mg/kg/dose every 12 hours |
|  | | Glycerin LIQUID rectal suppository | 1 mL/dose |
| **Analgesic/Sedation** | | | |
| Acetaminophen (IV) | 10 mg/kg/dose every 12 hours | Morphine | 0.05 – 0.1 mg/kg/dose every 2 - 4h PRN |
| Acetaminophen (Oral) | 10 mg/kg/dose every 8 hours | Midazolam | 0.05 – 0.1 mg/kg/dose every 2 - 4h PRN |
| Dexmedetomidine | 0.2 – 2 mcg/kg/hr | Vecuronium | 0.1 mg/kg/dose |

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| **On call MD** | 843-8121 | **Liz Todd, Surgery NP** | 843-4547 |
| **McMahan** | 841-2018 | **L3 Charge** | 843-8115 |
| **Queliz** | 843-5536 | **L2 Charge** | 841-0058 |
| **Winn** | 843-4396 | **Blood Bank** | 841-2255 |
| **Gomez** | 843-2711 | **Chaplain** | 843-3222 |
| **Orsini** | 843-4397 | **Dietitian** | 407-981-3333 |
| **Amy Kelly Vega, NNP** | 843-9104 | **Palliative** | 407-981-0801 |
|  |  | **Pharmacist (Sindhu)** | 407-980-0424 |
|  |  | **Pharmacy APH** | 841-1396 |
|  |  | **Pharmacy WPH** | 843-2330 |
|  |  | **Radiology** | 841-1432 |
|  |  | **Resident** | 841-2934 |

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| **Tiniest baby Saturation - VENTILATION GOALS** | | |  | **HFJV (jet)** |
| These limits apply to this patient for the duration of their stay or unless otherwise ordered | | |  | **\*\*\* Initial Jet settings for pt < 1000 g for RDS \*\*\***  Jet PIP 22-24 Jet Rate 360bpm Jet Ti 0.02 Seconds  IMV PEEP 5, IMV PIP 1 over PEEP Rate 2 Ti 0.5 |
|  |
| Corrected Gestational Age | Target Saturations | Alarm Limits |  | **\*\*\* Airleaks/PIE Settings \*\*\***  ↓**JET Rate** by 60 bpm to a low of 240 bpm as tolerated  Tolerate higher FiO2↓**Conventional rate** to 0 |
| < 32 weeks | 85-93% | 80-95% |  | **\*\*\* Typical Adjustment on Jet \*\*\***  ↑Jet PIP by 1-2 →↓ pCO2 by 2-4 mmHG *(& vice versa)*  ↑Jet PIP by 2-4 →↓ pCO2 by 5-8 mmHG *(& vice versa)* |
| ≥ 32 weeks | 90-95% | 85-98% |  | Jet Rate Range: 240-660 bpm - increase rate can improve oxygenation and ventilation |
| ≥ 32 weeks on RA or < 1 l/min on 100% Oxygen | >94% | 90-100% |  | ↑Oxygenation ↑ Jet PIP, Conv. PIP *& PEEP*  *by 1-2* cm at the same time |
| Target CO2 |  |  |  | **\*\*\* Sigh breaths \*\*\***  IMV Rate 4-12 IMV PIP 5-10 over PEEP Ti 0.5  No need to wean unless air leak develops |
| 45-55 first 3 days  45-60 next 4 days |  |  |  |

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| **ADMISSION FLUIDS** |  | **Necrotizing Enterocolitis Empiric Antimicrobial Selection** | | | | |
| Total fluids: 120 – 140 mL/kg/day  UAC fluids: TPN Neo Starter D5% AND ¼ sodium acetate with 0.5 units/mL heparin to run at a total of 1 mL/hour  UVC fluids: TPN Neo Starter D5%  \*\*If unable to obtain either a UAC or UVC, Y-site in both TPN and ¼ sodium acetate through one line |  |
|  | Initial infectious workup recommendations:  1. Blood culture prior to antibiotics for Modified Bell’s Criteria 3 a/b  2. Peritoneal culture if surgical management required | | | | |
|  |
|  | *Empiric Antimicrobial Selection and Duration for NEC*  **Modified Bell’s Criteria** – to be assessed by the NICU attending | ≤ 7 days of life | > 7 days of life | Duration of therapy (days) |
|  |
| **ENTERAL FEEDS** |  | **1 a/b**  Clinically suspected  Blood in stool  Apnea and bradycardia  Lethargy | Ampicillin and gentamicin | Ampicillin and gentamicin | 3 |
|  |
| NPO on admission |  | **2 a**  Dilation/Ileus  Pneumatosis  Abdominal Tenderness | Ampicillin and gentamicin | Zosyn | 7 |
| DOL 1:  ≤ 23 6/7 weeks: start trophic feeds at 1 mL Q6H  24 0/7 – 24 6/7 weeks: start trophic feeds at 1 mL Q3H |  |
| DOL 2:  ≤ 23 6/7 weeks: Advance to 1 mL Q3H  24 0/7 – 24 6/7 weeks: Continue 1 mL Q3H |  | **2 b**  Portal venous gas  Ascites  Thrombocytopenia  Metabolic acidosis | Ampicillin and gentamicin | Zosyn | 10 |
| DOL 3:  ≤ 23 6/7 weeks: Continue to 1 mL Q3H  24 0/7 – 24 6/7 weeks: Advance by up to 20 mL/kg/day to goal of 160 mL/kg/day |  |
| DOL 4:  ≤ 23 6/7 weeks: Advance by 1 mL daily to goal of 100 mL/kg/day  24 0/7 – 24 6/7 weeks: Continue advancing to goal |  |
| ≤ 23 6/7 weeks: Feeds at goal   * < DOL 10: Hold feeds of unfortified breast milk at 100 mL/kg/day and continue PN and SMOF Lipids. * ≥ DOL 10 and tolerating feeds 100 mL/kg/day:   + Initiate Prolacta+6 mixed to 24 Kcal/oz\*; advance feeds by 1 mL daily to goal and wean PN and SMOF Lipids   + Once at goal, increase to standard Prolacta+6\*   \*if renal function and electrolytes are normal |  | **3 a/b**  Hemodynamic compromise  Resp/metabolic acidosis  DIC  Neutropenia  Pneumoperitoneum | Ampicillin and gentamicin | Vancomycin and Zosyn | 10 |
| 24 0/7 – 24 6/7 weeks:  Initiate Prolacta+6 once feeds reach 80 – 100 mL/kg/day  Begin weaning PN and SMOF Lipids as feeds are advanced |  |

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| **BLOOD PrODUCTS** | |  | **BLOOD TRANSFUSION** | |
| **Cryo** | 10 ml/kg IV over 1h (*fibrinogen <100)* |  | **Hb level** | **Consideration** |
| **FFP** | 10-15 ml/kg IV over 1h *(PT >20, PTT >100)* |  | < 11.5 | Ventilated with > 60% O2 |
| **pRBC** | 15-20 ml/kg over 4 hours |  | < 10 | Ventilated  CPAP >50% O2 |
| **Platelets** | 15-20 ml/kg IV over 1-2 hours |  | < 8 | CPAP < 50% OR NC 100%  RA but symptomatic |

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| **PHOTOTHERAPY: TBC** | | | | | | | |  | **TBC Platelets Guidelines** | |
|  | Platelet count (x 109/L) | Consideration |
| **BW (g)** | 1d | 2d | 3d | 4d | 5d | 6d | 7-14d |  | <30 | At all times |
| < 1000 | 5 | 5 | 5 | 5 | 5 | 5 | 7 |  | 30-49 | Within 72 hours of life  Previous significant hemorrhage  (i.e., grade 3 or 4 IVH)  Coagulopathic  Prior to surgical procedure  Post op 72 hours  Unstable with use of pressors |
|  |  |  |  |  |  |  |  |  | 50-99 | Active bleeding Before and after neurosurgical procedures |