\*The intent of this product is to be a resource; not a replacement for institutional protocols. Standard 1 of AmSECT’s Standards and Guidelines for Perfusion Practice.1 These Standards and Guidelines may also be superseded by the judgement of the healthcare professional taking into account the facts and circumstances of the individual case.

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| **SUBJECT/TITLE** | **PREGNANT PATIENT**  |
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| **PURPOSE:** | To provide a guideline and resource when caring for a pregnantpatient. |
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| **TARGET POPULATION:** | Pregnant patients needing cardiopulmonary bypass. |
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| **DEFINITIONS:** | Pregnant patients may need to undergo cardiac surgery due to a preexisting cardiac issue exacerbated by or created by pregnancy. If surgical intervention becomes necessary during the pregnancy, it should occur as late as possible in the pregnancy.Generally, it’s considered the 2nd trimester is after the first trimester organogenesis; but before the maximum maternal hemodynamic stress. |

**POLICY:**

1. Pregnant patients have increased circulating blood volume, cardiac output and as a result, decreased hematocrit. Special considerations should be taken to accommodate the increased flow and oxygen demands.
2. Certain medications and rewarming can induce uterine contractions and premature labor.
3. Consider appropriate OB and NICU personnel on standby for premature delivery.

**PERFUSION PUMP CONSIDERATIONS:**

1. Pregnant patients have increased circulating blood volume and cardiac output
	1. An oxygenator capable of oxygenating 30-50% more blood than typically assigned to that patients’ weight/size.
	2. Pump flow should be calculated using a 2.6-3.0 L/min/m2 cardiac index.(1)
2. The pregnant patients’ increased blood volume may be disproportionate to the increased plasma volume, meaning hemostasis and anticoagulation may be different than typical.(2)
3. Pregnant patients often tend to be in a hypercoagulable state and usually require substantially higher than usual doses of heparin. \*Heparin is 20 kDa and will NOT cross the placenta and endanger the fetus. (2)
4. An increase in heparin dosing is required. While the heparin doesn’t cross the placenta, it can create an increased risk of uterine hemorrhage for the mother.
5. Heparin dosing and limitations should be determined by the surgeon and anesthesiologist.
6. Increased frequency of anticoagulation testing is recommended
7. A fetal cardiac monitor (bilateral probe) and abdominal doppler is suggested. (1,4)
8. Selection of vasoactive and inotropic agents should be carefully considered.
9. Alpha agonists should be avoided due to their restriction of placental blood flow.

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| **Avoid with pregnant patients** |
| Norepinephrine/Phenylephrine -alpha agonist, constrict uterine vessels and reduce flow, may stimulate uterine contraction |
| Furosemide- crosses placenta, may decrease placental perfusion, may prevent normal plasma volume expansion |
| Thiazide – crosses placenta, induces electrolyte imbalance, may increase risk of congenital defects, secondary fetal bradycardia |
| Nitroprusside – crosses placenta, possible cyanide toxicity, reduced fetal blood flow. |
| Propranolol – crosses placenta, intrauterine growth retardation, fetal bradycardia, fetal toxicity, reduced uterine blood flow |
| Verapamil- crosses placenta, may reduce uterine blood flow with fetal hypoxia |

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| **Acceptable for pregnant patients** |
| Hydralazine- crosses placenta, vasodilator of choice, will decrease blood pressure in mother, while increasing renal and uterine blood flow |
| Digoxin – crosses placenta without causing harm, drug of choice for persistent fetal bradycardia |
| Quinidine – Cross placenta, related to fetal thrombocytopenia, used with digoxin to treat fetal supraventricular tachycardia \*2nd drug of choice after digoxin |
| Atropine – crosses placenta, no effect on uterine activity, fetal heart rate |
| Dopamine- no known adverse effects, increases uterine blood flow, may stimulate contractions |
| Epinephrine- vasopressor of choice |
| Atenolol- Crosses placenta with no fetal malformations, decrease in fetal heart rate may occur |

**PROCEDURE**:

1. Place the patient in a mild, left lateral tilt position by elevating the right hip.
	1. Helps rotate the uterus away from the IVC which will help with venous return. (1,2)
2. Femoral cannulation should be avoided if possible due to decreased femoral venous drainage. Femoral arterial cannulation may cause hypo-perfusion to the uterus.
3. Right atrial scavenging of cardioplegia may be an option to maintain a low potassium level, which is critical to not inducing fetal arrhythmias. (1)
4. Monitor blood gas levels diligently
5. Blood glucose levels should remain in normal range to replenish depleted fetal glycogen stores. (2)
6. Adequate hematocrit should be maintained to assure oxygen delivery to the fetus (1,3)
	1. Excess hemodilution of progesterone may cause premature contractions
7. Pump flow should reflect the increased cardiac index demand
8. Efforts should be made to avoid hypotension. There is no uterine autoregulation and therefore hypotension will result in fetal hypotension. (3)
9. Monitor fetal heart rate <60BPM and any uterine contractions
10. Fetal bradycardia may be an indication of poor fetal perfusion (4)
11. Maternal core temperature should remain >34C
	1. Rewarming may cause fetal bradycardia, induce contractions, and premature labor. (1,2,4)
12. Tocolytics drugs (labor suppressants) such as magnesium sulfate or ritodrine should be available. (4)

**CLINICAL ASSESSMENT/SCREENING**:

1. Contraindications: None

# RELATED DOCUMENTS:

1. n/a

# REFERENCES:

1. Lynch BV, Brown DM. The manual of clinical perfusion. 2 nd ed. Fort Myers, FL: Perfusion.com, 2004
2. Mongero L, Beck J. On Bypass: Advanced Perfusion Techniques. Totowa, NJ: Humana Press, 2008.
3. Alexis A, Origer P, Hacquebard JP, Canniere DD, Germany O, Vandenbossche JL et al. Anesthetic management of a voluminous left atrial myxoma resection in a 19 weeks pregnant with atypical clinical presentation. Case Reports in Anesthesiology. 2019; 1-6.
4. Hensely FA, Martin DE, Gravlee GP. A practical approach to cardiac anesthesia. 4 th ed. Philadelphia, PA: Wolters Kluwer, 2008.

# DISCLAIMER:

In emergency situations, immediate life support measures of whatever appropriate nature come first with attention turning to measures described in this protocol/process as soon as possible and practical.

This is a minimal protocol/process that may be exceeded at any time based on the judgment of the involved patient care personnel.

This protocol/process encourages high quality patient care but observing it cannot guarantee any specific patient outcome.

This protocol/process is subject to revision from time to time, as warranted by the evolution of technology and practice.

Review period: Review as changes occur or per institutional policy

Original hard copies and computer copies of this protocol are stored under the supervision of the Chief Perfusionist, Department of Cardiovascular Perfusion.

Documents relating to patient care standards are developed according to the accepted hospital standards.

# APPROVED BY: *(signature of CMO and CNE only required)*

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