\*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 Standard 1 of AmSECT’s Standards and Guidelines for Perfusion Practice.1 These Standards and Guidelines may also be superseded by the judgement of the healthcare professional taking into account the facts and circumstances of the individual case.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** | **ANGIOMAX (Bivalirudin)** |
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| **PURPOSE:** | To describe alternative anticoagulation for patients unable to acceptheparin (unfractionated or fractionated). |
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| **TARGET POPULATION:** | Patients unable to accept unfractionated heparin. |
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| **DEFINITIONS:** | Angiomax ® (Bivalirudin) is an anticoagulant used in patients with a diagnosis of heparin-induced thrombocytopenia/heparin-induced thrombocytopenia thrombotic syndrome (HIT/HITTS) undergoing cardiac surgery with cardiopulmonary bypass support (CPB). Angiomax ® (Bivalirudin) is a direct thrombin inhibitor that undergoes reversal in a short time frame without the need for a pharmacological reversal agent. (Protamine does not reverse Angiomax) |

**PERFUSION PUMP CONSIDERATIONS:** see Procedure

**POLICY:**

* The use of Angiomax (Bivalirudin) for HIT patients is considered off-label use for extracorporeal support. The use of this medication must be authorized by the operating surgeon and utilized following institutional protocol.
* The use of Angiomax (Bivalirudin) during cardiac surgery for anticoagulation requires specific preoperative, intraoperative and postoperative actions. This is due to its alternative mechanism of action and metabolism when compared to standard unfractionated heparin anticoagulation.
* Angiomax (Bivalirudin) is often used due to its rapid onset, short half-life, lack of antibody formation, and low side effect profile.
* The half-life of bivalirudin also allows for a shorter time needed to achieve a goal therapeutic aPTT.
* Limitations for bivalirudin use include possible excessive bleeding due to lack of antidote, **Protamine does not reverse Angiomax** (Bivalirudin), prolonged effect with renal dysfunction, and difficulty in monitoring.
* Angiomax (Bivalirudin) has limited dependence on renal mechanisms for elimination, suggesting that this agent may be better suited than some alternatives in patients with renal dysfunction.
* Anticoagulation management should be determined by the surgeon prior to surgery.
* Adjustments in plasma concentration of Bivalirudin are best achieved with bolus dosing

**PROCEDURE:**

**Bivalirudin Dosing Schedule: *On-Pump Considerations:***

1. **Before initiation of cardiopulmonary bypass:**
	1. A bolus of 50 mg Bivalirudin is added to the circuit.
		1. Give regardless of patient weight or volume of the prime
	2. Bolus dose of 1.0 mg/kg IV - before surgical incision
	3. Infusion of 2.5 mg/kg/hr for the duration of the planned anticoagulation period.
		1. This should achieve a mean steady state plasma Bivalirudin concentration of +12.3 ± 1.7mcg/mL.
	4. ACT should be 2.5x baseline or >350 seconds
2. Redosing/maintenance:
	1. If a higher level of anticoagulation is desired, administer additional boluses of 0.1-0.5 mg/kg. These can be repeated as clinically indicated.
3. Discontinuation of Bivalirudin Support:
	1. Approximately 15 minutes before coming off bypass, discontinuation may be considered, discuss with the surgical team.
	2. Or, discontinue the use of Bivalirudin at weaning, then use Modified Ultrafiltration (MUF) once off CPB to remove any remaining Bivalirudin
		1. Remaining conscious of the lack of anticoagulation as MUF is used.
4. After terminating CPB, if re-initiation is required:
	1. 50 mg bolus of Bivalirudin should be put into the pump circuit
	2. Followed by a continuous infusion of 50 mg/hr
5. If it is clear that a return to CPB will not be needed, then the volume in the circuit should be sent to the cell saver for processing before re-administration to the patient.

**Bivalirudin Dosing Schedule: *Off-Pump Considerations:***

1. The dosing below is based on achieving a goal ACT of >300 seconds.
	1. Bolus dose of 0.75 mg/kg IV - before chest incision
	2. Infusion of 1.75 mg/kg/hr

**CLINICAL ASSESSMENT/SCREENING:**

1. Contraindications: None

# RELATED DOCUMENTS:

1. Heparin Induced Thrombocytopenia
2. Anticoagulation for Adult Cardiopulmonary Bypass

# REFERENCES:

1. Baker RA, Bronson SL, Dickinson TA, et al. Report from AmSECT's International Consortium for Evidence-Based Perfusion: American Society of Extracorporeal Technology Standards and Guidelines for Perfusion Practice: 2013. J Extra Corpor Technol. 2013;45(3):156-66.
2. Ibrahim, W., Nakia, H., Stephen, M., Bruce, S., Bryan, W., &; William, P. (2018). A Patient With Remote Heparin-Induced Thrombocytopenia and Antiphospholipid Syndrome Requiring Cardiopulmonary Bypass: Do Current Guidelines Apply? Seminars in Cardiothoracic and Vascular Anesthesia.
3. Tsu, L. V., &; Dager, W. E. (2011). Bivalirudin Dosing Adjustments for Reduced Renal Function with or Without Hemodialysis in the Management of Heparin-Induced Thrombocytopenia. Annals of Pharmacotherapy,45(10), 1185-1192.

# 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 when changes occur or per institutional protocol.

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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| Source: | (originating department/committee) |
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