CLINICAL POLICY

Pulmonary Hypertension Evaluation

A. EFFECTIVE DATE:
September 21, 2021

B. PURPOSE:
To measure cardiopulmonary hemodynamics at rest, with exercise, and with acute vasodilator testing to determine the etiology of the pulmonary hypertension.

C. POLICY:
Patients with suspected pulmonary arterial hypertension (PAH) will have resting hemodynamic measurement during a right heart catheterization. Patients with suspected left heart disease will have resting and may have exercise hemodynamic measurements during a left and right heart catheterization. In patients with suspected idiopathic, heritable, or anorexigen induced PAH, hemodynamic measurements may be performed following acute vasodilator testing.

D. SCOPE:
This policy applies to all inpatients, ED, and Ambulatory Clinic locations.

E. DEFINITIONS:

1. **Pulmonary arterial hypertension** – mean pulmonary arterial pressure (mPAP) > 20 mmHg, pulmonary artery wedge pressure (PAWP) ≤ 15 mmHg and a pulmonary vascular resistance (PVR) ≥3 Wood units[1].
2. **Acute vasodilator testing** – measurement of hemodynamics prior to and after inhalation of nitric oxide[2].
3. **Vasoresponder** - after inhalation of nitric oxide, a decrease in mean pulmonary artery pressure of ≥10 mmHg to an absolute mean pulmonary artery pressure of ≤40 mmHg with either an improved or unchanged cardiac output is considered a positive response[2].

F. MATERIAL(S) NEEDED:
Nitric oxide delivery device and nitric oxide tanks
Supplemental oxygen source
Oxygen face mask
Extension tubing and adaptors
Continuous ECG monitoring
Continuous pulse monitoring
Continuous pulse oximetry
Continuous hemodynamic monitoring (pulse and blood pressure)
AVOX Co-Oximeter
500 cc saline bags

G. PROCEDURE:

1. Patient admitted to Procedure Center 1.5 - 2 hours prior to procedure.

2. Patient transferred to Cardiac Catheterization Laboratory and consent obtained for procedure by MD.

3. Right and left catheterization insertion performed by the attending interventional cardiologist.

4. Baseline hemodynamic variables recorded: mean right atrial pressure, right ventricular pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, cardiac index, thermodilution cardiac output, pulmonary vascular resistance in Wood Units, systematic vascular resistance, oxygen saturation of pulmonary artery and aorta. If performing left sided catheterization include left ventricular end diastolic pressure measurement.

5. Nitric oxide & oxygen (100%) delivered to patient (via face mask) for inhalation (under the supervision of the respiratory care practitioner).

   -Administer 100% oxygen for 5 minutes
   -Add nitric oxide at 20 ppm for maximum of 5 minutes or until a positive response is seen[3, 4, 5]

6. Record hemodynamic variables: mean right atrial pressure, right ventricular pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, cardiac index thermodilution cardiac output, pulmonary vascular resistance in Wood Units, systematic vascular resistance, oxygen saturation of pulmonary artery and aorta. If performing left sided catheterization include left ventricular end diastolic pressure measurement.

7. Contraindications for nitric oxide testing include a cardiac index < 2.0 L/min/m^2 or a pulmonary capillary wedge pressure > 15 mmHg. In the event of respiratory distress and/or hemodynamic compromise, the nitric oxide testing will be discontinued, and appropriate measures taken.

8. For patients ≥ 65 years of age where there is a high index of suspicion for left sided heart disease and the mean pulmonary artery pressure is ≥ 20 mmHg, and pulmonary artery wedge pressure is 13-15 mmHg, administer 500 ml normal saline bolus over 5-10 minutes as a fluid challenge and/or add exercise in the form of pumping arms while holding 500 ml saline bags in each hand for 3-5 minute[2].

9. Record hemodynamic variables (mean right atrial pressure, right ventricular pressure, mean pulmonary artery pressure, pulmonary capillary wedge pressure, cardiac index, thermodilution cardiac output, pulmonary vascular resistance in Wood Units, systematic vascular resistance, oxygen saturation of pulmonary artery and aorta) following fluid and/or exercise challenge. If performing left sided catheterization include left ventricular end diastolic pressure measurement.

10. At the completion of the procedure, the right heart catheter and arterial catheter will be removed.

11. All patients will be scheduled for a follow-up visit in the pulmonary vascular disease program post catheterization procedure.

H. ATTACHMENTS:

None

I. REFERENCES:

1. Simmonneau G, Montani D, Celermajer DS, et al. Haemodynamic definitions and updated clinical classification of pulmonary hypertension. Eur Respir J 2019; 53: 18019113; **DOI:** 10.1183/13993003.01913-2018
2. Galie N, Humbert M, Vachiery J-L, et al. 2015 ESC/ERS Guidelines for the diagnosis and treatment of pulmonary hypertension : The Joint Task Force for the Diagnosis and Treatment of Pulmonary Hypertension of the European Society of Cardiology (ESC) and the European Respiratory Society (ERS): Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC), International Society for Heart and Lung Transplantation (ISHLT) *Eur Heart J*. 2016;37:67-119; DOI: 10.1183/13993003.01177-2015
3. Pepke-Zaba J, Higenbottam TW. Inhaled nitric oxide as a cause of selective pulmonary vasodilatation in pulmonary hypertension. Lancet. 1991;338:1173-74.
4. Sitbon O, Brenot F, Denjean A, et al Inhaled nitric oxide as a screening vasodilator agent in primary pulmonary hypertension: a dose-response study and comparison with prostacyclin. Am J Respir Crit Care Med. 1995;151:384-389.
5. Ricciardi MJ, Knight BP, Martinez FJ, Rubenfire M. Inhaled nitric oxide in primary pulmonary hypertension: a safe and effective agent for predicting response to nifedipine. J Am Coll Cardiol. 1998;32:1068-1073.

J. SEARCH WORDS:

Pulmonary hypertension

K. ENFORCEMENT:

Violations of this policy or associated procedures may result in appropriate disciplinary measures in accordance with University By-Laws, General Rules of Conduct for All University Employees, applicable collective bargaining agreements, the University of Connecticut Student Code, other applicable University Policies, or as outlined in any procedures document related to this policy.

L. STAKEHOLDER APPROVALS:

On File

M. COMMITTEE APPROVALS:

None

N. FINAL APPROVAL:

1. Andrew Agwunobi, MD (Signed) 09/29/2021
   Andrew Agwunobi, MD, MBA Date
   UConn Health Chief Executive Officer

2. Anne D. Horbatuck, (Signed) 09/29/2021
   Anne D. Horbatuck, RN, BSN, MBA Date
   Clinical Policy Committee Co-Chair

3. Scott Allen, MD (Signed) 09/27/2021
   Scott Allen, MD Date
   Clinical Policy Committee Co-Chair

4. Caryl Ryan (Signed) 09/17/2021
   Caryl Ryan, MS, BSN, RN Date
   Interim Chief Operating Officer, JDH
   VP Quality and Patient Services & Chief Nursing Officer

O. REVISION HISTORY:

Date Issued: 12/03
Date Revised: 1/10, 1/16
Date Reviewed: