

HEMODYNAMIC ALTERATIONS ON A PRE-OPERATIVE PATIENT WITH HYPOPLASTIC LEFT HEART SYNDROME (HLHS) VIA A VAPOTHERM NASAL CANNULA WITH SUB-AMBIENT OXYGEN

Douglas Petsinger BS, RRT, Kevin Maher MD, Angel Cuadrado MD, Janet Simsic MD

INTRODUCTION: A term 2.95Kg female with the diagnosis of hypoplastic left heart syndrome (HLHS) was transferred to the cardiac intensive care unit (CICU) at Children's Healthcare of Atlanta the first day of life. She was admitted on room air, 0.3mcg/Kg/min of PGE-1, normal sinus rhythm (NSR) of 140bpm, respiratory rate of 68bpm, an arterial blood pressure of 50/39mmHg with a MAP of 44mmHg, and a lactic acid at 11.4 mg/dL. The initial ABG was 7.37, PaCO₂ of 35 torr, PaO₂ of 44 torr, and a base deficit of -4 with a calculated SaO₂ of 79%. The patient was tachypneic without the presence of nasal flaring, grunting, accessory muscle usage, or retractions. The patient's condition worsened as characterized by increasing SpO₂, persistent metabolic acidosis, an increase in lactic acid production, and decrease in urine output (UOP) over a twelve hour period. The patient was placed on a 19% 1 LPM nasal cannula due to worsening hemodynamic status related to unrestricted pulmonary blood flow (PBF). The sub-ambient nasal cannula was accomplished by powering the O₂ side of a blender with N₂: medical air powered the air side. One flow meter was dedicated for the bubble humidifier and a separate flow meter was dedicated to an alarmed O₂ monitor (Miniox, Pittsburgh, PA, USA). Further evidence of torrential PBF: SpO₂ >96% and arterial diastolic pressure of 26 – 28 mmHg was noted, cannula flow was increased to 2LPM and FiO₂ was decreased to 0.17. The patient's condition continued to deteriorate demonstrated by a decrease of UOP and a lactic acid level of 25.0 g/dl. **CASE SUMMARY:** Prior to endotracheal intubation, mechanical ventilation, paralysis, and sedation-analgesia the patient was placed on a Vapotherm Nasal Cannula System device (Vapotherm, Stevensville, MD, USA) as a rescue attempt. The initial settings were 6 LPM and 17%. The patient's condition improved demonstrated by the following metabolic and hemodynamic indices.

CICU Hr	Mode/Flow/ FiO ₂	Base/HCO ₃	Lactic Acid (g/dl)	SaO ₂ / PaO ₂	NIRS R/L	UOP cc/Kg/Hr
0	0.21	-4 / 19	11.4	84% / 51	68% / 65%	3.5
24	NC/1LPM 19%	-4 / 19	19.4	84% / 50	63% / 65%	4.6
40	NC/2LPM 17%	-4 / 22	25.0	77% / 46	60% / 62%	2.3
42	Vapotherm/ 6LPM 17%	0 / 25	15.6	76% / 41	62% / 63%	
53	Vapotherm/ 6LPM 17%	0 / 26	12.7	85% / 51	67% / 65%	4.9

Post institution of Vapotherm strategy, the patient remained stable for the next twelve hours as evidenced by a significant decrease in lactate acid production, a positive metabolic status without NaHCO₃ infusion, and an increase in UOP until a surgical palliation could be performed. **DISCUSSION:** Pre-operative management of patients with single ventricular (SV) physiology can range from low dose PGE-1 infusion and newborn cardiac care to endotracheal mechanical ventilation with paralysis, sedation, and analgesia. The use of a high flow nasal cannula (HFNC) strategy via Vapotherm in conjunction with sub-ambient gas mixture provides a route to decrease excessive PBF, improve hemodynamics, and decrease the associated sequela of instrumentation and mechanical ventilation. The HFNC strategy does not incorporate elaborate headgear and possible skin and nasal breakdown. The increased cannula flow provided an improved pulmonary capillary bed-alveolar interface as evidenced by an increased pulmonary vascular resistance (PVR) thus improving systemic cardiac output (C.O.) indicated by a decrease in lactic acid production and an increase in UOP.

OF-05-044