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CASE SERIES EVALUATING THE EFFICACY OF A BICAVAL SINGLE-LUMEN ECMO CATHETER IN NEAR-FATAL ASTHMA

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Learning Objectives: Near fatal asthma (NFA) is responsible for 80-85% of all asthma related deaths. NFA is characterized by a severely elevated PCO₂, pH of < 7.2 on arterial blood gas (ABG), need for mechanical ventilation and significantly elevated peak inspiratory pressures (PIP) on mechanical ventilation (MV). Traditional strategies with MV involve low tidal volume (Vt) to avoid pneumothorax while waiting for the supportive medications to take effect. However, low Vt prohibits adequate gas exchange, leaving the patient in a persistent respiratory acidosis. There have been multiple case reports of using dual site cannulation extracorporeal membranous oxygenation (ECMO) as rescue therapy for NFA. We present a case series of NFA patients who received ECMO with bi-caval single lumen cannulation for NFA in evaluation of its efficacy.

Methods: A retrospective review of the ECMO database available at a single center urban academic tertiary referral center in Virginia was done for patients with NFA as the primary diagnosis. A total of 7 patients spanning from 2014 to June 2018 qualified. Data were collected through chart review from our electronic medical record.

Results: The age ranged from 8 to 59. Four of the patients were female. The cannula size ranged from 23 to 31 French. The insertion sites were all in the right internal jugular vein. Average arrival pH and PCO₂ were 6.98 and 153.8, respectively, and 7.01 and 148.2 immediately prior to cannulation. The first normalized pH and PCO₂ averaged 7.37 and 38.7, respectively. Average time to pH correction was 2 hours and 24 minutes. The initial MV had an average PIP and Vt of 45.7 cm H₂O at an average of 3.9 mL/kg tidal volume. ECMO duration averaged 6.6 days. ICU and hospital lengths of stay averaged 12 and 13.7 days, respectively. No pneumothorax occurred. Bleeding from cannulation site was the only complication of the procedure. Patients were transfused an average of 1.1 units of PRBC, 0.4 units of platelets, and 0.1 units of plasma. All patients survived to discharge.

Conclusions: In patients with NFA, the use of a bi-caval single lumen ECMO is an effective alternative to traditional treatments. Rapid reversal of the profound acidosis prevent prolonged myocardial depression, renal insufficiency, hepatic injury and possible cardiac arrest while avoiding barotrauma induced pneumothorax, excessive sedation needs and prolonged hospitalization. This life saving therapy should be considered early in patients with NFA.

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THE VITAMIN B12 ANALOG COBINAMIDE: EFFICACY EVALUATION AS A MULTICHEMICAL AGENT ANTIDOTE

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Learning Objectives: Humans can be exposed to a wide range of toxic metabolic chemical threat agents in mass casualty events. Treatment options for effective medical response during intentional or accidental toxic chemical exposures are a high priority for chemical countermeasure development. No effective antidote exists to quickly neutralize the potentially fatal effects for many metabolic threat agents, which inhibit electron transport and oxygen utilization through inhibition of Cytochrome c oxidase. An agent that can be given quickly, by intramuscular injection in the field to treat civilian or military personnel for multiple threat agents is needed.

Methods: We investigated the effects of the B12 precursor, cobinamide (COB) to treat 3 metabolic agents: cyanide (CN), hydrogen sulfide (H₂S) and methyl-mercaptan poisoning, in 2 animal species models (mice and rabbits). Such threat agent antidote candidates cannot be tested for efficacy in humans, and FDA approval is through the Animal Rule Pathway

Results: In the lethal CN inhalation model (587ppm), all mice in the control group (CN gas exposure only) died before the end of the exposure (survival time <34 min) versus 83.3% survival after receiving COB (p< 0.0001). In rabbit cyanide poisoning, average survival time was 77 min for control vs. 119 min in the COB group (p<0.02). In the methyl-mercaptan exposure model (1250 ppm), no mice survived in the control group (average time to death, 36.7 min), while all mice in COB arm survived the full term of exposure (60 minutes) (p=0.0016). In the rabbit model, the average survival time was 36 min in controls compared to 58 min in the COB group (p=0.01). In the H₂S mouse model control, no mice survived (average time to death was 34.5 min) vs. 100% survival in the COB treated group (120 min) (p=0.004). Survival of rabbits administered H₂S (at ~2000ppm) averaged 12.6 minutes until death for untreated animals vs. 18.5 minutes for COB treated (p<0.02).

Conclusions: This is the first report of a rapidly acting intramuscular single agent that improved survival times following exposure to 3 different metabolic gas poisons. The promising results in these studies merit further investigations for the potential development of cobinamide to treat poisoning from a range of metabolic threat agents

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