

Extracorporeal Membrane Oxygenation Rescue for Severe Aspiration Pneumonitis in Two Patients after Roux-en-y Gastric Bypass Procedure

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Abstract: Roux-en-y gastric bypass (RYGB) is one of the most common weight loss surgical procedures performed in the United States. Early post-operative small bowel obstruction is a rare but potentially morbid, complication of RYGB. We report two patients who underwent RYGB and required subsequent treatment for a post-operative small bowel obstruction. Their post-operative course was complicated by severe aspiration pneumonitis leading to hypoxemic respiratory failure requiring rescue with femoral veno-venous extracorporeal membrane oxygenation (V-V ECMO). Both patients were successfully

extubated, weaned off V-V ECMO support, and discharged to home. These cases highlight the potential role of V-V ECMO for patients who have undergone RYGB and develop severe aspiration pneumonitis. They also highlight the need for cautionary use of gastrografin in RYGB patients. Early engagement of a multidisciplinary team experienced with adult ECMO is vital for favorable patient outcomes. **Keywords:** extracorporeal membrane oxygenation, gastrografin, aspiration pneumonia, roux-en-y gastric bypass, morbid obesity. *J Extra Corpor Technol. 2021;53:199–203*

Nearly one in five patients admitted to an intensive care unit has obesity or morbid obesity (1). The treatment of patients with morbid obesity who develop severe aspiration pneumonitis requiring extracorporeal membrane oxygenation (ECMO) poses many challenges. Mongero and colleagues are the only ones to report successful ECMO support for severe aspiration pneumonitis in roux-en-y gastric bypass (RYGB) patients (2). Here, we report the successful use of veno-venous (V-V) ECMO in two patients who developed aspiration pneumonitis after operative treatment for early small bowel

obstruction following RYGB. We discuss the challenges of V-V ECMO in patients with morbid obesity as well as issues related to inter-facility transport, nutrition, and gastrografin-related aspiration pneumonitis.

DESCRIPTION

Case 1

A 56-year-old female with a history of morbid obesity (BMI = 62 kg/m²), hypertension, diabetes, hyperlipidemia, and gastroesophageal reflux disease underwent robotic-assisted laparoscopic RYGB without any noted complications. Approximately 7 weeks after surgery, she presented to a nearby hospital with nausea and vomiting. Computed tomography (CT) imaging revealed dilation of the remnant stomach and biliopancreatic limb. A small bowel series with gastrografin demonstrated dilated loops

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of the small intestine, consistent with small bowel obstruction. On induction of anesthesia for a diagnostic laparoscopy, she vomited gastric contents with subsequent aspiration. She was quickly intubated and underwent a bronchoscopy, which enabled the clearance of the vomitus content. The patient underwent laparoscopic lysis of adhesions. The point of obstruction was noted to be an inflammatory adhesion just distal to the jejunojejunostomy. She was extubated post-operatively but intubated soon thereafter for increasing respiratory distress and hypoxia. Over the next several hours, her respiratory status significantly decompensated. Chest radiographs demonstrated bilateral infiltrates consistent with aspiration pneumonitis (Figure 1A). She had persistent acidosis ($\text{pH} = 7.17$), with her pO_2 decreased to 37 mmHg despite maximal conventional ventilator support, paralytics, and inhaled nitric oxide. She was on two vasopressors secondary to the severe metabolic and respiratory acidosis. A multidisciplinary discussion was done as part of the ECMO consultation process with the hub hospital, and she was deemed to be a good candidate based on single organ dysfunction leading to severe hemodynamic derangements. The patient was deemed to be too unstable to be transported without cannulation at the spoke hospital, and the mobile ECMO program was dispatched with the surgeon and a perfusionist. The patient was quickly stabilized with femoral 23FV–21FV femoral–femoral cannulation resulting in rapid improvement of the oxygenation status. After stabilization, she was transported via helicopter to our tertiary care center.

An endoscopic nasojejunal tube placement was completed on post-operative day 2 for enteral nutrition. She was managed on V-V ECMO with traditional low tidal volume, lung protective ventilation, and diuresis to achieve a net negative goal. Once mechanics were suitable, she was extubated 6 days after initiation of V-V ECMO and was decannulated 8 days after initiation. Other hospital events included an incidental right lower lobe sub-segmental pulmonary embolus. She was discharged home 16 days after V-V ECMO therapy was

discontinued. She was tolerating a bariatric pureed diet, had no neurologic sequelae, and did not require supplementary oxygen. Chest radiograph on the day of discharge demonstrated significant improvement (Figure 1B), and the 6-month follow-up appointment demonstrated no noted respiratory issues.

Case 2

A 56-year-old woman with a past medical history of morbid obesity ($\text{BMI} = 38 \text{ kg/m}^2$), diabetes, and asthma underwent laparoscopic RYGB without noted complications. Approximately 10 days after surgery, the patient presented with a small bowel obstruction secondary to an umbilical trocar site hernia. This was confirmed via CT scan with IV contrast. Of note, gastrografin was given for a routine post-operative swallow study approximately 10 days prior and was noted to still be in the proximal small bowel. She vomited on induction of a diagnostic laparotomy with suspected aspiration of gastric and intestinal contents. She underwent bronchoscopy after intubation, which confirmed enteral contents in the airway. She underwent a laparoscopic reduction of the trocar site hernia, a primary hernia repair, and an intra-operative esophagogastroduodenoscopy. She remained intubated after operation given aspiration pneumonitis concerns.

Her respiratory status post-operatively declined with significant acidosis ($\text{pH} = 7.26$) and hypoxia despite increased ventilator support ($\text{pO}_2 = 44 \text{ mmHg}$) and paralytics use. Her chest radiograph (Figure 2) was consistent with aspiration pneumonitis, and she had progressive respiratory failure. After a multidisciplinary discussion, the decision was made to place the patient on V-V ECMO at the spoke hospital. She underwent placement of a right internal jugular 31F Avalon catheter (Getinge, Wayne, NJ) for V-V ECMO. After stabilization, she was transported via helicopter to our tertiary care center.

She was extubated the following day (V-V ECMO day 1) but had to be re-intubated on V-V ECMO day 3 for worsening tachypnea. Endoscopic nasojejunal tube placement was completed on post-operative day 5. She was

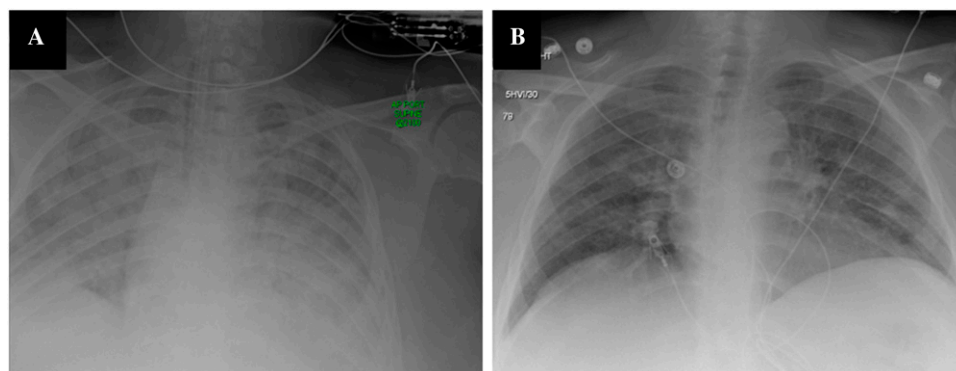


Figure 1. (A) Chest radiograph of first patient demonstrating bilateral infiltrates consistent with severe aspiration pneumonitis. (B) Chest radiograph of the same patient on the day of discharge.

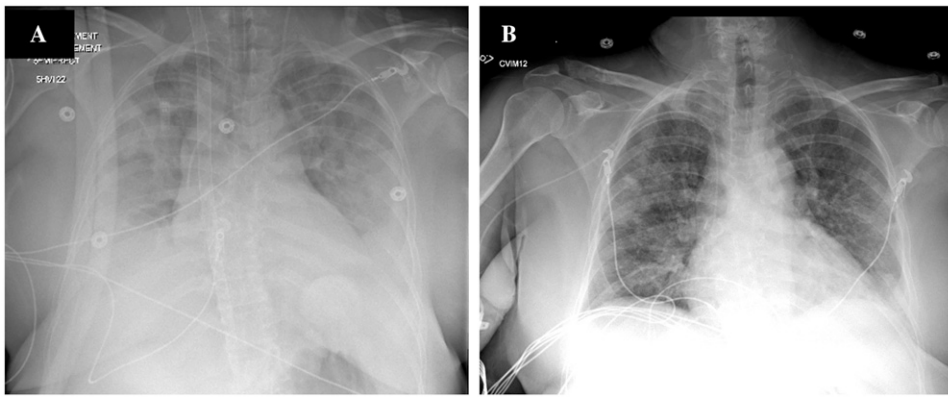


Figure 2. (A) This chest X-ray depicts the patient's diffuse pulmonary opacities/edema on the day of cannulation. (B) This chest X-ray was taken 8 days after the initial image, and it shows the improvement in air space disease after decannulation and extubation.

decanulated 6 days after initiation of V-V ECMO and successfully extubated the following day. She was discharged home 9 days after her hernia surgery tolerating oral liquids, ambulating, and on room air. Chest radiographs on the day of discharge (Figure 3A) and approximately 1-year post-V-V ECMO (Figure 3B) demonstrated significant improvement. She underwent a laparoscopic cholecystectomy approximately 13 months following her ECMO therapy without incident.

DISCUSSION

Although associated with potential challenges, the use of ECMO in patients with morbid obesity and respiratory failure is safe and feasible (3–5). In a retrospective analysis of the Extracorporeal Life Support Organization (ELSO) database evaluating over 1,400 patients, obesity was not associated with worse mortality in patients requiring V-V ECMO (5). Kon et al. reported their single-center experience with V-V ECMO support in obese patients; surprisingly, they found a stepwise improvement in survival with increasing BMI (4). Proposed mechanisms

for such a protective signal could include early indication for rescue prior to severe parenchymal lung injury due to issues with chest wall compliance (4).

Challenges with ECMO in the morbidly obese patient are many. Potential issues include difficult vascular access and altered flow rates. To support early ambulation and limit debility, these patients would benefit from a double-lumen cannula. However, the safe and proper cannulation requires image-guided positioning, and this may not be possible due to weight limitations of the radiographic table, and limitations at the cannulation facility as was in our first case. Transesophageal echocardiogram, if readily available, may be used to facilitate cannula placement in operative suites. Unfortunately, morbid obesity can also cause poor image quality (6,7). When unavailable, or when patient characteristics preclude the use of appropriate imaging, dual site cannulation for V-V ECMO access may be preferable and the most amenable to highest flow rates (8). Percutaneous access can be performed even in extremely obese patients, but modified cannulation methods are needed for the patient's body habitus and distorted landmarks. It is crucial to have ample personnel to move the pannus to be able to safely

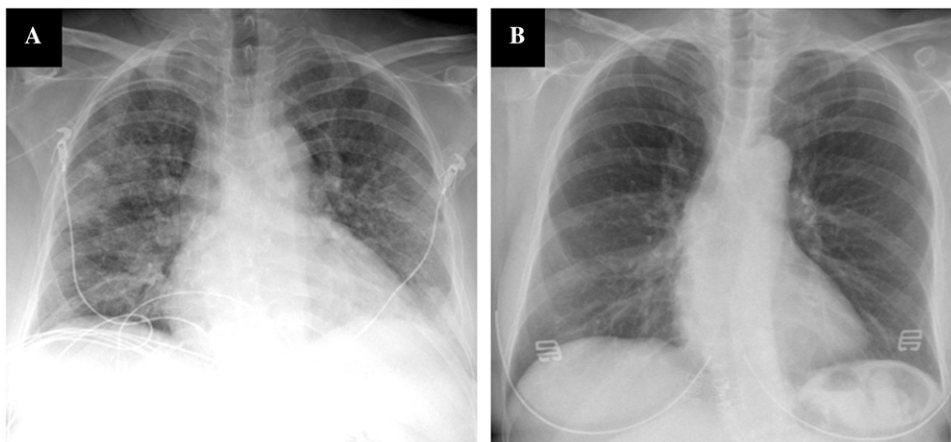


Figure 3. (A) Chest radiograph of the second patient on the day of discharge. (B) Chest radiograph approximately 1-year post-ECMO therapy in the same patient.

cannulate with ideal real-time visualization with ultrasound. This can be obviated in some cases with V-V ECMO using an Avalon catheter and internal jugular vascular access and/or the use of longer access needles and firmer vascular access guidewires (2,9).

Of important consideration, as occurred in the cases presented in this manuscript, are the challenges posed when patients are too unstable for transfer to a tertiary care facility without being placed on ECMO prior to transport. First reported in 1986 (10), multiple series have demonstrated that the inter-facility transport of patients on ECMO is safe and feasible with comparable survival rates (8–11). It does, however, come with significant cost and time constraints. A large series was published describing a single institution experience of 221 patients requiring transport on ECMO over a 20-year period. They reported that each transport required the commitment of a minimum of five transport team members for an 8–12-hour time period (11).

In patients who have undergone RYGB and present with small bowel obstruction, the use of oral contrast agents (i.e., gastrografin) during the imaging work-up should be done with exceptional care. Gastrografin, given the high osmolality, leads to rapid, severe, and sometimes fatal pulmonary edema upon aspiration (12). Gastrografin-induced aspiration pneumonitis can be a lethal complication (13). Kadakia et al. reported on two morbidly obese patients who suffered aspiration pneumonitis from gastrografin requiring ECMO support (7). Likewise, gastrografin may have contributed to the severity of the aspiration pneumonitis in the cases presented in this manuscript. Although gastrografin has significant utility in the management of patients with small bowel obstruction, both as a diagnostic and potentially therapeutic modality, we must be cautious with its use in RYGB patients presenting with obstructive symptoms. For patients who have undergone RYGB, small bowel obstructions generally indicate a technical complication (early), or other etiology such as an internal hernia that inevitably requires operative intervention. Therefore, the use of gastrografin in this specific patient population should be used carefully.

Management of patients on V-V ECMO can use several strategies as it relates to mechanical ventilation (14–17). In one well-designed, prospective study, multivariate analysis found no association between ventilator settings during the first two days of ECMO and survival (16). A higher tidal volume and lower driving pressure across the ECMO were found to be associated with better outcomes (16). Studies have shown that patients can be safely extubated on V-V ECMO support, and this potentially offers the benefit of a reduced need for sedatives, and thereby reduced morbidity as it relates to delirium. Another advantage that this strategy offers is to further

limit ventilator-induced lung injury, ventilator-associated pneumonia, and inadvertent aspiration of stomach contents. Extubation while on ECMO support poses all of the above advantages. Ongoing tachypnea and distress potentially cause reintubation such as in patient 2, which could pose its own set of disadvantages. This is an area that is still unclear in literature and warrants further studies.

V-V ECMO has become an invaluable tool in patients with severe respiratory compromise who are not otherwise responsive to more conventional modes of ventilator support. A growing body of literature continues to show that obesity is not a contraindication to ECMO, and utilizing a multidisciplinary approach may be the most efficient way to streamline resources. We believe that the hub-and-spoke model enables rapid consultation and early involvement of the perfusionist and cannulating physician resulting in rapid stabilization of the patient. Although there are technical and logistical challenges, ECMO is considered a life-saving modality for these patients as well. Early engagement of a team experienced with adult VV ECMO as well as the inter-facility transport of patients on ECMO is vital for favorable outcomes.

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