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Challenges in the Anesthetic Management of Patients with Severe Pulmonary Hypertension Undergoing Gastrointestinal Endoscopic Procedures Under Sedation

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ABSTRACT

Introduction: Gastrointestinal (GI) endoscopic procedures nowadays are commonly performed requiring deep sedation. Sedation is associated with a risk of cardiopulmonary events, the leading cause of morbidity and mortality with GI endoscopies. Patients with pulmonary hypertension (PH) may be at a higher risk for perioperative complications. There is little evidence supporting any specific pre-procedure testing or anesthetic technique during the procedure. A multidisciplinary team approach can be implemented peri-operatively to guide preoperative assessment, intra-operative management, and post-operative care, and the procedure location could be moved to the operating rooms (ORs), or to the cardiac ORs if specialized equipment is needed. Our aim is to evaluate the safety of providing sedation for patients with pulmonary hypertension in the GI endoscopy unit when there is little time for adequate preoperative optimization and when cardiac ORs and special equipment are not readily available.

Methods: This is a case-series study describing the hemodynamic changes observed in 3 patients with pulmonary hypertension who presented to the GI endoscopy unit. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software.

Results: Our study included 3 patients who underwent urgent gastroscopy and colonoscopy endoscopies for workup of anaemia. The average procedure time was 46 minutes. Sedation was delivered through Fentanyl 50 mcg boluses titrated to a maximal dose of 100 mcg, and a Propofol infusion at the rate of 25-30 mcg/kg/min for the 3 patients. Table 1 shows the various patient demographics, and indicates that there was no statistically significant change in the perioperative vital signs measured for every patient, including the heart rate (p=0.621), the systolic blood pressure (p=0.895), the diastolic blood pressure (p=0.849) and mean arterial pressure (p=0.856). Furthermore, mean satisfaction scores on a 10 point-scale were high in the 3 patients (9.3), the providing Anesthesiologists (9.6) and the gastroenterologists performing the procedure (9).

Conclusion: The perioperative management of patients with PH is complex, and to this day, evidence-based guidelines are not available. The main goal is to provide good patient comfort during the procedure while maintaining adequate hemodynamic. Our report suggests that sedation could be delivered safely for patients with pulmonary hypertension undergoing urgent GI endoscopy, especially in a resource limited setting, and sets the groundwork for future research investigating the disparity in outcomes, morbidity and mortality between procedures performed in the regular endoscopy unit and those performed in a more advanced theatre such as the cardiac units.

BACKGROUND

Gastrointestinal (GI) endoscopic procedures are commonly performed nowadays requiring anesthesia with deep sedation [1]. Sedation is associated with a risk of cardiopulmonary events, the leading cause of morbidity and mortality with GI endoscopies [2].

Patients with pulmonary hypertension (PH), defined as "a mean pulmonary artery pressure 25 mm Hg at rest coupled with a pulmonary capillary wedge pressure 15 mm Hg and an elevated pulmonary vascular resistance (PVR) >3 Wood units" [1]. Changing demographics and improved survival rates in the modern era have contributed to the increased number of these complex patients [3]. The presence of PH is associated with higher rates of cardiopulmonary adverse events when compared to the general population undergoing GI endoscopy [1], including respiratory failure, congestive heart failure, arrhythmia, myocardial ischemia, kidney injury and hemodynamic instability [3], and morbidity and mortality risks increase considerably for those patients who have the most severe forms of hemodynamic derangements [3].

Quite often we are faced with patients with multiple comorbidities, including moderate to severe pulmonary hypertension as diagnosed by a pre-performed echocardiography, who present to undergo emergency endoscopy procedures for diagnosis of a potential bleeding in the GI tract. Endoscopy procedures are considered low risk procedures compared to other surgical procedures, yet those patients still pose a challenge to the

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providing anesthesiologist. To our knowledge there has not been a clear consensus on the management of such patients.

There is little evidence supporting any specific pre-procedure testing or intervention. In general, assessment of a number of factors, including etiology and severity of PH, functional status, other co-morbidities, type and urgency of the procedure, and medication optimization should be performed [3]. Consultation with a PH specialist can also be considered for further management. Postoperative planning for patient disposition should also be considered, as most complications arise in this period [3].

Table 1: Patient Demographics and Peri-Operative Vital Signs.

Demographics		Patient 1	Patient 2	Patient 3	P-value
	Age	37	53	70	
	Gender	Female	Male	Male	
	PH Class	Moderate	Severe	Severe	
HR	Pre-op	103	68	63	0.621
	Mean intra-op	90	61	59	
	Post-op	94	59	113	
SBP	Pre-op	130	165	114	0.895
	Mean intra-op	115	196	136	
	Post-op	118	186	105	
	DBP Pre-op	86	60	67	0.849
	Mean intra-op	70	83	61	
	Post-op	74	76	76	
MAP	Pre-op	101	95	83	0.856
	Mean intra- op	90	119	89	
	Post-op	89	113	86	

*PH = Pulmonary Hypertension, HR = Heart Rate, SBP = Systolic Blood Pressure, DBP = Diastolic Blood pressure.

Pre-op = Pre-operative, Intra-op = Intra-operative, Post-op = Post-operative, MAP=Mean arterial pressure. **p-value <0.05 is considered significant.

Similarly, there is little evidence supporting any specific anesthetic technique or intervention during the intraoperative period [3]. An individualized plan should be established on a case-bycase basis. There is a general consensus that right ventricular function should be maintained, and inciting events that could provoke pulmonary vasoconstriction or systemic hypotension should be avoided [3]. According to the currently present literature, a variety of anesthetic techniques can be used to achieve appropriate hemodynamic goals, none of which has been proven superior, and include options such as local or regional anesthesia, or general anesthesia with controlled ventilation [3]. Some suggestions included combining a benzodiazepine with ketamine, which can prevent ketamine-induced pulmonary vasoconstriction by decreasing the amount of catecholamine released [3]. Another important point was the avoidance of pure alpha agonists due to their effects on the pulmonary vasculature, and, alternatively, vasopressin which has limited effects on the pulmonary vasculature, should be used [3].

We present the case of a 53-year-old gentleman, previously diagnosed with Chronic renal insufficiency status post renal transplantation 10 years prior to presentation, on triple immunosuppressive therapy, with a baseline creatinine ranging from 2.2 – 2.3 mg/dL -Essential hypertension on triple therapy -Coronary artery disease and severe aortic stenosis status post coronary artery bypass graft surgery and aortic valve replacement 1 years prior to presentation -Diabetes mellitus type 2 on insulin treatment Who was planned for an upper and lower GI endoscopy for the workup of abdominal pain and a decrease in Hgb to 8.0 g/dL down from a baseline of 8.9 g/dL. The patient also showed an elevated serum Creatinine level from his established baseline, at the level of 3.25 mg/dL. An echography performed at the time of admission was significant for the following results: - Normal LV systolic function with an estimated LVEF 60-64% - Grade II diastolic dysfunction - Severe left atrium dilatation - S/p bioprosthetic aortic valve (Perimount 23 mm) with an Aortic PPG/MPG 52/32 mmHg - Mild mitral stenosis - Mild to moderate pulmonary valve regurgitation with severe pulmonary hypertension And an electrocardiogram (EKG) showed: Normal sinus rhythm with lateral T wave inversion and poor R wave progression The patient was awake and alert. Baseline vital signs were taken before starting the procedure and were withing normal limits except for an elevated blood pressure reading of 195/90. We approached the case in the following manner: -The patient was attached to standard American Society of Anesthesiologists (ASA) monitors, including a continuous EKG, non-invasive blood pressure, peripheral pulse oximeter, and endtidal carbon dioxide monitor -Oxygen was provided by nasal cannula at the rate of 5 L/min -A bilateral superior laryngeal nerve block was performed by injecting 2mL of 2% lidocaine bilaterally over the hyoid bones, by anatomical landmarks to guide the direction of needle insertion -Sedation was delivered through a small bolus of fentanyl 50 mcg The patient tolerated insertion of the gastroscope and was HD stable. His blood pressure remained elevated and ranged from 176/89 – 191/96.

When switched to colonoscopy, the patient felt discomfort and pain, his blood pressure rose to 210 systolic, and his heart rate rose to 110 beats/min. This was promptly managed by giving another fentanyl bolus 50 mcg and a propofol infusion was started at the rate of 25 mcg/kg/hr. The patient tolerated the procedure afterward which ended without any major events. To note that his workup returned negative for any GI bleeding. Considering the new guidelines from the AHA, what would be a good approach for perioperative management of patients with PH, especially in the emergency situation when there is little time for adequate optimization? Furthermore, after we proceed, what are our hemodynamic goals and what is the best way to achieve them?

Conflict of interest: None

Ethical Consideration: Not required

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