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Hypopharyngeal Oxygenation for High Acuity EGDs (Herby Method)

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1. Introduction and Discussion

Critical high morbidity (hospital based) ASA 3 and 4 out and inpatient EGD caries a 3x risk of Anesthesia morbidity and mortality in some studies. Clearly, it is a high risk setting in hospital GI labs with general non-use of secure airway devices for brief (MAC/GA) cases. High volume and the brief deep propofol anesthesia culturally preclude a standard GA with a secure airway (LMA/ET), inhalation agents or other longer acting anesthetic agents. The author feels the underlying risks associated with EGDs in compromised/high acuity ASA III and IV patients is the lack of cardiopulmonary reserve due to age, airway obstruction and a multiplicity of underlying diseases (cardiac, pulmonary, metabolic (obesity/DM) and neurologic. The author also strongly contends the underlying morbidity and mortality with unprotected airways during EGDs is directly related to multifactorial hypoxemia (persistent O2 saturation < 90%).

There is a fine line between adequate procedural anesthesia and apnea/airway obstruction and resultant hypoxemia. Apnea/bradypnea and decreased minute volume ventilation with high flow oxygen methods using nasal prongs and varying masks are helpful but limited due to partial or complete airway obstruction (relaxed tongue/posterior pharyngeal tissues/jaw collapse and nasal turbinate hypertrophy/nasal septum deviations). The anesthesiologist job is to maintain oxygenation and VS in the setting of airway obstruction for a short but potentially unknown duration. Many compromised patients begin desaturation within 5 seconds of standard dosages of propofol due to the immediate apnea/bradypnea, partial or complete airway obstruction, decreased FRC, decreased TV/RR and hypoxemic hypopharyngeal inspiratory oxygen levels (a combination of CO2, air and limited oxygen from supplemental oxygen source using above nasal/oral airflow (3-15 L/min.)

Combating airway obstruction and hypoxemia in the setting of needing to provide anesthesia for a strong stimulus of an endoscope with many activated mucosal sensory receptors is a difficult, yet skilled anesthesia task without use of an airway device (LMA/ET). Most standard anesthesia methods utilize chin lifts/jaw thrusts, nasal trumpets (not insignificant nasal bleeding/blood thinners), high flow O2 with masks, nasal prongs (many not extending beyond the base of the external nostrils), and added positive pressure. Short of using an ET or LMA, the standard propofol induction and maintenance anesthesia invites hypoxemic risk. Despite the above maneuvers, a high percentage of ASA III and IV patients become hypoxemic (< 90% O2 saturation). This endoscopic technique deviates from standard anesthesia training and safety. The dosage of propofol varies dependent on metabolic and overall cardiopulmonary reserve, use of illicit drugs/alcohol/THC/narcotics - benzodiazepines/SSRIs/etc. (clinical hyperalgesia), and body habitus. Endoscopic insufflation (especially with air (nitrogen expanding closed contained spaces) causes diaphragm elevation and has substantial negative effects on respiratory exchange and mechanics (decreased FRC and adverse V/Q abnormalities).

The author for years has noted high/unacceptable O2 desaturations (<90%) in this compromised EGD (ASA III and IV) patient population with mostly required adequate levels of anesthesia - especially immediately post induction. Resultant tachycardia/bradycardia/rarely AV blocks, EKG abnormalities in rhythm and subtle S-T

changes of a high degree can be discerned in many high-risk cases - along with high and low BPs. Propofol as a negative inotrope and chronotropic agent in a depleted (NPO) compromised patient is a substantial risk for aberrant CV responses - as contrasted with a standard highly controlled GA induction in a typical OR setting.

Combatting the clinical situation above, the author over 5 years studied in and outpatient EGDs in compromised ASA III and IV patients using high flow hypopharyngeal oxygenation during exclusive propofol anesthesia for EGDs. Study summarization below.

2. Materials and Methods

Consents were not completed due to use of standard approved OR/GI devices, high volume and bias issues surrounding being in a study/HPPA/etc. 525 patients over 5 years were studied by the author in a hospital GI Lab setting. We are oxygenating ASA 3/4 patients at high risk for MAC/GA with all the respiratory tools/airway devices at our disposal. All patients at the hospital settings as outpatients were too ill for GI ASC treatments (high risk). Inpatients with an assortment of GI maladies (generally bleeding) were all high acuity. All patients received standard propofol titrated inductions and maintenance from 30 - 500 mg. with monitoring of VS and nasal O2 flow of 5-8 l/min. Maintenance propofol varied with small aliquots and occasional infusions based on length of procedure.

After GA induction with CO2 nasal curves abolished (obstruction and/or apnea), the endoscope was introduced. Following endoscope entrance into the esophagus, a lubricated NG tube (16 F) was introduced orally outside the protective endoscopic mouthpiece and advanced into the hypopharynx. Anesthetizing extreme high-risk cases, we visualized the NG tube orifices just above the vocal cords. The multi-orifice (10) distal end NG tube was severed proximally at the site of the blue vent connection. Thus, a single lumen NG tube (now termed Herby Tube) used as an O2 delivery device via the suction port was established for connection to a separate O2 tank. Nasal O2 at 5 L/min was maintained. The separate oxygen source at 4-8 L/min flow was then initiated into the hypopharynx. 525 patients were recorded regarding loss of CO2 curve, hypoxemia (defined as O2 saturation < 90 %), VS and adequate anesthesia. The goal was to maintain oxygenation in the setting of providing adequate procedural anesthesia.

3. Results

100% of patients had adequate deep anesthesia - with more Anesthetic agent administered than previous administrations by myself historically. Endoscopists noted less endoscopic stimulation effects, patient movement and other signs of “light” anesthesia.

Hypoxemia - O2 saturation below 90% - 19 patients - quickly returned to > 90% within brief time (seconds), chin lift, stimulation and one nasal trumpet insertion. Zero LMA/intubations required.

Inability to pass NG tube into hypopharynx - 4 patients (NG tube remained in upper pharynx - with probably positive O2 hypopharyngeal diffusion effect).

GI procedure affected by NG tube - 3 patients (NG pulled to back of throat - still some positive effective additional oxygenation). Dilations, Pegs, EUS and endoscope reinsertions required Herby tube (NG) to be pulled back and reinserted occasionally to facilitate procedure.

NG tube acceptance by endoscopists was universal – not affecting their procedural needs. Endoscopists felt clinically they had TIME to complete a thorough procedure rather than being rushed due to clinical anesthesia deterioration/VS - hypoxemia (not uncommon in this high acuity population).

Side effects: 2 patients had bleeding small oral mucosal tears (resolved in minutes); One NG tube advanced into proximal esophagus causing excess stomach insufflation (no clinical harm). Probable a small minority of patients had tip of NG tube into proximal esophagus unviewed endoscopically with no harm and still clinical benefit due to proximal orifices (total10) near larynx.

Positive effects: No case was stopped due to consistent hypoxemia and deeper levels of anesthesia were achieved allowing non-hurried more thorough EGD procedures. EGD cases lasting to 45 minutes (EUS) with complete airway obstruction remained with high O2 saturation (98-100%). Interesting, during all cases with flat CO2 nasal graphic monitor curves nor perceptible warm airflow nasally or orally, > 95% of patients remained well oxygenated. Propofol titration despite airway obstruction resulted in comfortable procedural levels of anesthesia by observing continued diaphragmatic movements (small TVs exchanging with rich hypopharyngeal source of oxygen (V/Q match)).

Propofol was titrated to end point based on diaphragm movement (small TVs without significant airway exchange from the nasal or oral source of oxygen and use of hypopharyngeal oxygenation). The Herby Method technique resulted in excellent oxygenation in nearly all patients.

Clinically, hypercarbia to a degree probably resulted with no ill side effects. O2 flow at the hypopharyngeal level most probably caused CO2 egress - maintaining a balanced 1 Atm Pressure.

Herby method as above was successfully utilized 3x under immediate consultation in a second GI procedural room (in lieu of ET/LMA in cases where O2 saturation had marked immediate decline post propofol induction for critically ill EGD patients) - avoiding emergent airway instrumentation.

4. Conclusion

Hypopharyngeal oxygenation (bypassing universal partial or complete airway obstruction) using a separate oxygen source at reasonably high flows through a NG plastic multi-orifice Herby Tube allowed improved deeper levels of propofol administered anesthesia

for GI procedural effectiveness (Endoscopists comments). Overall marked consistent reliable improvements in pulse oximetry (most patients remained at 99-100%) occurred with the Herby Method. There was no significant medical risk or patient harm associated with the Herby Method in this study.

Addendum: ACLS for multiple years has steadily veered away from active provider ventilation and supplemental oxygenation due to 18% oxygen (air) chest recoil airway exchange seemingly as effective as limited assisted oral/nasal ventilation during standard CPR. The author feels that improved immediate hypopharyngeal oxygenation methods as above employing the Herby Method may lead to improved immediate outcomes in compromised CPR patients before airway devices are available/utilized successfully. Critical compromised patients require immediate oxygen for optimal cellular function in all tissues. Infrequent provider exhaled breaths into the victim at 16% oxygen is inadequate for cellular resuscitation in most critical settings (author's opinion based on treating thousands of compromised OR surgical cases – where 100% delivered oxygen with adequate MV makes a demonstrable clinical difference in outcome).

Based on the above clinical rationale, the AHA is strongly considering trials of the Herby Method. The author feels that AEDs, Herby tubes and small oxygen tanks need to be highly accessible in CPR settings – but further research is required. In an acute situation, utilizing hypopharyngeal oxygenation with chest recoil victim inspirations may provide markedly improved oxygenation as compared to limited trained public oral/nasal V or trained standard mask V (not uncommonly difficult) due to airway obstruction. Obviously, airway devices (LMA/ET) with use of high flow oxygen are the most optimal treatment for ACLS needs. The Herby Method may however provide a life/neurologic saving bridge before advanced techniques and providers are available.