PERFORMANCE OF THREE NASAL CANNULAS AND TWO ORAL BITE BLOCK DEVICES FOR END TIDAL CO2 MONITORING DURING SEDATION FOR UPPER GI ENDOSCOPY, A COMPARATIVE BENCH STUDY

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Background: Upper GI endoscopy are typically performed using conscious sedation.[1] Drug-induced respiratory depression is a major cause of serious adverse effects during sedation. Recently, many manufacturers have introduced new models of monitoring bite blocks and sampling nasal cannulas that facilitate CO2 monitoring to assess breathing during sedation. However, the utility of these devices for CO2 monitoring has not been evaluated. This bench study was designed to compare the performance of three nasal cannulas and two oral bite block which are commonly used in conscious sedation especially during the EGD.

Methods: We connected a mannequin head to one side of a two-compartment test lung model by a 7.0mm endo-tracheal tube with its opening in the nasopharyngeal position. (Fig 1) The other lung compartment was driven by a ventilator to mimic "patient" inspiratory effort. In this spontaneously breathing lung model, we evaluated the YX GE nasal mask (Yong-Xu medical instrument Co., Ltd. Taiwan), The Hauge airway bite block (Penlon, UK), CO25 Bite Block (Encompas Unlimited, Inc., FL), a conventional nasal canula (Adult Nasal Cannula 032-10-020, Flexicare Medical Limited, UK), Flexicare dual nare nasal cannula (Flexicare Medical Limited, UK), a CO2 sampling nasal cannula (Adult Divided cannula 4707-7-7-25, Salter Labs, CA), and an Oral-Trac nasal cannula (Adult Divided Oral/Nasal Cannula 4797, Salter Labs, CA) at various oxygen flow rates and over a range of mouth opening apertures. Note that a Flexicare dual mask (Flexicare Medical Limited, UK) was also tested in an upside down configuration to allow insertion of an upper GI scope. Test lung compliance was set to 50 ml/cm H2O with a simulated airway resistance of 8.2 cm H2O/ (L*s). Simulated rate and volumes were12 /minute with 500 ml and 8 /minute with 300 ml. Pneumatic resistors in different sizes were applied in the mouth of Manikin head to simulate different levels of mouth opening. CO2 measurements from two locations (at the sampling device and from a sampling gas port connected between the from the endotracheal tube and test lung) were compared. CO2 was measured using an anesthesia gas analyzer (CapnoMAC, Datex, Helsinki, Finland).

Results: With all devices, supplemental oxygen flow was increased from 1 L/min to 10 L/min. We observed a substantial decrease in EtCO2 values from tested devices when oxygen flow was increased while the measured decrease in EtCO2 was less when measured at the endo-tracheal tube. All observed etCO2 sampled from the test devices were lower than the corresponding measurement sampled at the endo-tracheal tube Different sizes of mouth opening played an important role in theetCO2 measured at both locations (see figure below).

Conclusion: Specially designed CO2 Monitoring oxygen delivery devices provide a good and acceptable method of monitoring etCO2 and respiratory rate for patients under conscious sedation for upper GI endoscopy. Oxygen flow to the device highly influences the etCO2 value measured from the side stream sampling either from devices in this bench manikin head study. In the sampling cannula, CO2 cannot be monitored if oxygen flow is high and the mouth is open.

References

1. Levitzky, B.E., et al., Moderate sedation for elective upper endoscopy with balanced propofol versus fentanyl and midazolam alone: a randomized clinical trial. Endoscopy, 2011.