“ROUTINE” PREOXYGENATION

It is a fact of great clinical importance that the body oxygen stores are so small, and if replenishment ceases, they are normally insufficient to sustain life for more than a few minutes. Breathing oxygen causes a substantial increase in the total oxygen stores; most of the additional oxygen is accommodated in the alveolar space (functional residual capacity) from which 80% may be withdrawn without the PaO2 falling below the normal vale. This concept is the basis of the preoxygenation technique.

In 1955, Hamilton and Eastwood demonstrated that denitrogenation of the functional residual capacity of the lung is 95% complete within 2-3 minutes, if a subject is breathing at a normal tidal volume form a circle anesthesia system using an oxygen flow of 5 l/min. These studies led to the recommendation of preoxygenation as a standard practice before rapid sequence induction of general anesthesia in patients with full stomach.

“Routine” preoxygenation has become a new “minimum standard” of care not only during induction of anesthesia and tracheal intubation, but also during emergence from anesthesia and tracheal extubation.

The original American Society of Anesthesiologists (ASA) difficult airway algorithm made no mention of preoxygenation. However, in an updated report of the ASA Task Force on “Management of the Difficult Airway” 2003, the topic of face mask preoxygenation before initiating management of the difficult airway was added.

Preoxygenation before induction of anesthesia was also recommended in patients with low functional residual capacity of the lung, associated with a high oxygen consumption. This category includes the neonates, the pregnant and the morbidly obese patients who rapidly decrease their oxygen saturation during apnea while breathing room air.

Preoxygenation is also recommended in patients with decreased oxygen delivery (Cardiac output x Hb conc x% saturation x 1.34) which include patients with low cardiac output or pulmonary disease, as well as patients with low or abnormal hemoglobin such as methemoglobin.

Before induction of general anesthesia, preoxygenation can be achieved either by tidal volume breathing of 100% oxygen for 3-5 minutes using an oxygen flow of 5 l/min as described by Hamilton and Eastwood, or by the 8 deep breaths technique for 60 seconds using an oxygen flow of 10 L/ min as described by Baraka et al. The mean time to decrease of hemoglobin oxygen saturation from 100% to 99% is significantly longer during the subsequent apnea following the 8-deep breaths technique of preoxygenation than following the traditional tidal volume preoxygenation technique. As suggested by Benumof, the 8 deep breaths technique may be considered the best method of preoxygenation for both efficacy and efficiency. The high efficiency of preoxygenation by the deep breaths technique may be attributed to a relatively larger minute volume, and/or to
possible expansion of any collapsed alveoli by the deep breathing technique.

The beneficial effect of preoxygenation by tidal volume or deep breathing, can be further extended during subsequent apnea by the apneic diffusion oxygenation\textsuperscript{7-9}. The technique of ADO has been advantageous not only in patients with a difficult airway or pulmonary disease, but also in children, the pregnant and the morbidly obese patients who have a high oxygen consumption associated with a relatively low FRC\textsuperscript{4}. ADO has been also used to maintain oxygenation during bronchoscopy\textsuperscript{7}, and one-lung ventilation\textsuperscript{10}.

Apneic diffusion oxygenation (ADO) is achieved by preoxygenation by tidal volume\textsuperscript{2}, or deep breathing technique\textsuperscript{5}, to be followed by insufflations of high flow of 100% oxygen by a catheter into the pharynx via an open airway. During ADO, the increase in time to hemoglobin desaturation achieved by increasing the FIO\textsubscript{2} from 0.9 to 1.0 is greater than that caused by increasing the FIO\textsubscript{2} from 0.21 to 0.9\textsuperscript{9}. During ADO, CO\textsubscript{2} is not exhaled because of the mass movement of oxygen down the trachea. The alveolar CO\textsubscript{2} concentration (PACO\textsubscript{2}) shows an initial rise of 8-16 mmHg during the first minute, followed by a subsequent fairly linear increase of about 3 mmHg/min. Thus, the ADO can maintain oxygenation for a prolonged period. However, the increase of PaCO\textsubscript{2} will limit the period of apnea.

In conclusion, preoxygenation has been initially recommended for rapid-sequence induction of anesthesia in patients with full stomach, as well as in patients with predicted difficult airway. However, the technique is nowadays recommended as a routine during induction, as well as during recovery from general anesthesia, since difficult airway may be unpredicted.

Preoxygenation, followed by apneic diffusion oxygenation is indicated in patients who desaturate rapidly during apnea such as the neonate, the obese and the pregnant patients who have a relatively low FRC associated with a high oxygen consumption. ADO is also advantageous in patients with decreased oxygen delivery such as the elderly, cardiac and pulmonary diseased patients. The technique is also used to maintain oxygenation during certain procedures such as bronchoscopy, and one-lung ventilation.

"Routine" preoxygenation with 100% oxygen is considered a “safety” measure during anesthetic induction and emergence from anesthesia, and is advantageous in critically-ill patients requiring airway management. However, it must be used as an adjunct rather than an alternative to a sequence of fundamental precautions that minimize adverse sequelae\textsuperscript{1}.

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References

The key to Lock-up Postoperative Pain

**STEP I**
Initial bolus
Inject 1 ampoule Tramal\texttrademark 100 mg i.v. or i.m. slowly over 2-3 minutes

**STEP II**
Ways of administration after initial bolus

- **Infusion\textsuperscript{1}**
  - Inject 3 ampoules Tramal\texttrademark, each 100 mg, in 500 ml of infusion solution.
  - Infusion rate 12-24 mg Tramal\texttrademark (10-20 ml/hour or 30-60 ml/hour).
  - Subsequent increments of 20 mg with a lock-out time of 5 minutes.
  - Usual dose 30 mg or 100 mg/44 hours up to a total daily dose of 400 mg (except in special clinical circumstances which might necessitate daily dose up to 600 mg).
  - If needed further doses of Tramal\texttrademark 50 mg up to a total of 260 mg (including the initial bolus) within the first 60 min.

- **PCA\textsuperscript{2}**
  - 1-2 capsules every 4-6 hours
  - 50 mg
  - 20-40 drops every 4-6 hours
  - 100 mg
  - 1 suppository every 4-6 hours

- **Injection\textsuperscript{3}**
  - slow release: 100 mg, 150 mg, 200 mg
  - 1 tablet every 12 hours

**STEP III**
Follow-up

- Intra-Operative
  - Loading Dose
    - 2.5 - 3 mg/kg\textsuperscript{4} at wound closure

- Post-Anaesthesia Care Unit
  - If intra-operative dose not given then BOLUS I.V.\textsuperscript{5}
    - 100 mg over 2-3 mins\textsuperscript{5}

An intra-operative loading dose of Tramal\texttrademark will reduce PONV rates\textsuperscript{6}.

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For patients with localized BURNING SHOOTING STABBING Neuropathic pain WORKS WHERE IT HURTS
BRIDION—*for optimal neuromuscular blockade management* and improved recovery

**Predictable and complete reversal**
- 98% of BRIDION patients recovered to a TOF ratio of 0.9 from reappearance of T₁ within 5 minutes²
- 97% of BRIDION patients recovered to a TOF ratio of 0.9 from 1 to 2 PTCs † within 5 minutes³

**Rapid reversal**
- BRIDION rapidly reversed patients from reappearance of T₂ ‡ in 1.4 minutes
- BRIDION rapidly reversed patients from 1 to 2 PTCs † in 2.7 minutes³

BRIDION is indicated for the reversal of neuromuscular blockade induced by rocuronium or vecuronium. In children and adolescents (aged 2-17 years), BRIDION is only recommended for routine reversal of moderate rocuronium-induced neuromuscular blockade ¹.

**Important safety information**
BRIDION is not recommended in patients with severe renal impairment. Studies in patients with hepatic impairment have not been conducted and, therefore, patients with severe hepatic impairment should be treated with great caution. Caution should be exercised when administering BRIDION to pregnant women as no clinical data on exposed pregnancies are available.

BRIDION has not been investigated in patients receiving rocuronium or vecuronium in the Intensive Care Unit (ICU) setting.

If neuromuscular blockade is required within 24 hours of BRIDION administration, a nonneostireal neuromuscular blocking agent should be used instead of rocuronium or vecuronium. The most commonly reported adverse reactions were dysgeusia (metal or bitter taste) and anesthetic complications (movement, coughing, grimming, or squelching on the endotracheal tube). In patients treated with BRIDION, a few cases of awareness were reported. The reaction to BRIDION was uncertain. In a few individuals, allergic-like reactions (e.g., flushing, erythematous rash) following BRIDION were reported. Clinicians should be prepared for the possibility of allergic reactions and take the necessary precautions. In a trial of patients with a history of pulmonary complications, brachypnea was reported in 2 patients and a causal relationship could not be fully excluded.

Volunteer studies have demonstrated a slight (12%-22%) and transient (<30 minutes) prolongation of the protrombin time/activated partial thromboplastin time (PT/aPTT) with BRIDION, however, clinical studies have demonstrated no clinically relevant effect on peri- or postoperative bleeding complications with BRIDION alone or in combination with anticoagulants. As BRIDION has demonstrated an in vitro pharmacodynamic interaction with anticoagulants, caution should be exercised in patients on anticoagulation for a pre-existing or comorbid condition. This pharmacodynamic interaction is not clinically relevant for patients receiving routine postoperative prophylactic anticoagulation. Although formal interaction studies have not been conducted, no drug interactions were observed in clinical trials. Preliminary data suggest that clinically significant drug interactions are unlikely with the possible exceptions of toremifene, fusidic acid, and hormonal contraceptives.

³ Train-of-four
² Post tetanic counts
‡ Second twitch

**REFERENCES**
1. BRIDION Summary of Product Characteristics (SPC)

Please see summary of product characteristics for full prescribing information.
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TAP Block And InfiltraLong
For Effective Treatment Of Long And Deep Incisions

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