Airway patency matters

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To the Editor,

In their review of preoxygenation, Tanoubi *et al.* calculated that a preoxygenated adult patient has a pulmonary oxygen reserve that would last nine minutes should the patient become apneic.¹ They base this calculation on estimates of available pulmonary oxygen reserves and oxygen consumption. Although the calculation is theoretically attractive because it illustrates the difference in oxygen reserves in non-preoxygenated and preoxygenated patients, we would argue that the calculation has little clinical relevance. What really matters under those circumstances is whether or not the upper airway is open.²

The principles of apneic oxygenation (well described 50 years ago) apply in a patient with an open airway. As long as oxygen is flushing over the airway, desaturation might not occur for 50 min or longer.³ Unfortunately, the nine-minute calculation is also misleading when the upper airway is not open, because the fact that oxygen causes resorption atelectasis is not taken into account.⁴ Functional residual capacity will decrease in a healthy adult patient by about 200 mL during the first minute after airway occlusion.² Pulmonary shunting can then cause more rapid desaturation, even in patients who are well preoxygenated. Therefore, to take advantage of the principles of apneic oxygenation, it is important to maintain an open airway during induction and to retain an open airway during apnea while oxygen is dispersed over the patient's face.

Although Tanoubi *et al.* gave an otherwise good review of an interesting subject, we feel that clarifying these issues would have improved their article.

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Competing interests None declared.

References

1. Tanoubi I, Drolet P, Donati F. Optimizing preoxygenation in adults. *Can J Anesth* 2009; 56: 449-66.
2. Nunn JF. *Applied Respiratory Physiology*, 3rd ed. Butterworth-Heinemann; 1987: 228-30.
3. Frumin MJ, Epstein RM, Cohen G. Apneic oxygenation in man. *Anesthesiology* 1959; 20: 789-98.
4. Edmark L, Kostova-Aherdan K, Enlund M, Hedenstierna G. Optimal oxygen concentration during induction of general anesthesia. *Anesthesiology* 2003; 98: 28-33.

In reply

We sincerely thank Drs. Ratsiu and Jonmarker for their interesting comments regarding our recent publication.¹ However, we do not think that our calculations “have little clinical relevance”. In clinical trials, the measured duration of apnea in healthy subjects without desaturation (DAWD) approached the calculated values of eight to nine minutes. In several articles, mean times were reported to have exceeded seven minutes until oxygen saturation decreased to < 90%,^{2,3} including in a study demonstrating atelectasis after breathing 100% oxygen.² The small difference between calculated and measured values is probably due mostly to the incomplete preoxygenation that occurs in practice and variations of the functional residual capacity between individuals. Drs. Ratsiu and Jonmarker also point out the importance of maintaining an open airway to avoid

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atelectasis. Needless to say, the principles of apneic oxygenation apply only when the airway is patent. In the initial description of the technique,⁴ a tracheal tube was in place and normoxia was maintained for as long as 50 min. After preoxygenation, the airway is not as secure as a tracheal tube; however, providing oxygen during the period of apnea via a nasopharyngeal catheter increases the DAWD,^{1,5} which suggests that the airway is patent during the apnea period. Then again, the technique has not been studied extensively, and it is uncertain how long the duration of apnea can be prolonged by providing oxygen into the pharynx. If anesthesiologists choose to provide oxygen into the pharynx, it appears prudent to avoid excessive pressure. In any event, even without oxygen during apnea, clinical studies show that preoxygenation offers additional time to secure the airway.

Competing interests None declared.

References

1. Tanoubi I, Drolet P, Donati F. Optimizing preoxygenation in adults. *Can J Anesth* 2009; 56: 449-66.
2. Edmark L, Kostova-Aherdan K, Enlund M, Hedenstierna G. Optimal oxygen concentration during induction of general anesthesia. *Anesthesiology* 2003; 98: 28-33.
3. Gambee AM, Hertzka RE, Fisher DM. Preoxygenation techniques: comparison of three minutes and four breaths. *Anesth Analg* 1987; 66: 468-70.
4. Frumin MJ, Epstein RM, Cohen G. Apneic oxygenation in man. *Anesthesiology* 1959; 20: 789-98.
5. Baraka AS, Taha SK, Siddik-Sayyid SM, et al. Supplementation of pre-oxygenation in morbidly obese patients using nasopharyngeal oxygen insufflation. *Anaesthesia* 2007; 62: 769-73.

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