Trauma and Emergency Care

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Commentary

Apnoeic oxygenation in the emergency department: New tricks from an old dog?

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Apnoeic oxygenation (AP OX), a technique established in 1959, classically involves the use of nasal cannulae in order to provide oxygen to a patient prior to or during endotracheal intubation [1,2]. No ventilation occurs throughout the intubation due to a decreased level of consciousness of the patient, usually as a result of the application of induction agents and neuromuscular blockers. However, it has been established that the oxygen delivered by the cannulae displaces nitrogen from the alveoli due to the principle of mass diffusion of gases [3]. As a result, this displacement enables a larger volume of oxygen to diffuse from the alveoli into the arterial circulation, and thus prolong time to hypoxaemia [4]. Consequently, it has been established that patients undergoing endotracheal intubation who receive AP OX are noted to have significantly longer 'safe apnoea times', a term used to describe the period of time before a patient undergoes critical desaturation as measured by pulse oximetry (SpO_2 ≤90%) [5]. AP OX has long been used in the setting of the operating theatre in order to extend safe apnoea times, and has also been established to prevent hypoxaemia during endotracheal intubation in ED, ICU and ward patients with and without respiratory failure [4-7]. However, it has only recently began to be employed within the setting of the emergency department (ED) to facilitate emergent rapid sequence intubations (RSIs) [5]. RSI involves an airway management technique in which the patient is immediately rendered unconscious with an induction agent, and is rapidly followed by global muscle relaxation with a neuromuscular blocking agent. This sequence is then completed by the insertion of an endotracheal tube under visual guidance, and attachment to a mechanical ventilator [8]. By performing the RSI, the emergent threatened airway can be safely and adequately managed [8]. However, intubation under emergent scenarios has been established to be fraught with potential adverse events [9], and thus research into improving the safety and efficiency of this area is currently highly sought.

A single-centre prospective observational study was conducted by Sakles *et al.* to discover the effects of AP OX on the success rate of first-pass success without the occurrence of hypoxaemia (FPS-H) during RSI [10]. During a 2 year period, emergency medicine residents documented the success of their FPS-H in 635 adult patients who underwent RSI within an ED setting [10]. It was found that 82.1% (n=312/380) of those who utilised AP OX achieved a successful FPS-H, whilst those who did not utilise AP OX achieved a 69% (n=176/255) success rate for FPS-H [10].

A further study by Sakles *et al.* explored the use of AP OX on patients with an intracranial haemorrhage (ICH) undergoing RSI within an ED setting [11]. The study, a multivariate logistic regression analysis, involved emergency medicine residents recording the oxygenation status of 127 adult patients with an ICH (n=49/127 traumatic ICH) who underwent RSI over a period of 2 years [11]. Twenty-nine percent (n=16/55) of patients who did not receive AP OX prior to RSI were found to desaturate (<90%) during the procedure, compared to 7% (n=5/72) of patients who received AP OX [11]. These findings translate to a seven-fold increase in the occurrence of desaturation during RSI in patients who did not receive AP OX when compared with those that did [11]. There was no measure of carbon dioxide (end tidal or arterial) included in this study.

Kim *et al.* utilised a prospective observational study to also examine the use of AP OX in ED patients requiring RSI, however, this study employed the use of non-invasive nasal positive pressure ventilators (NINPPV) [12]. The study states that the use of NINPPV minimises dead space ventilation through the maintenance of mildly positive end-expiratory pressures, and also delivers high pressures of oxygen through the nasal cavity, thus acting in a similar fashion as previously mentioned nasal cannulae [12]. Thirty patients enrolled in the study were pre-oxygenated via NINPPV prior to RSI, and all but one patient, due to a severe pneumonia, were then able to be maintained between 92 - 99% saturation throughout the procedure [12].

As has been established, the reinvigoration of AP OX within the ED setting to increase safe apnoea time in patients undergoing RSI demonstrates promising potential [10-12]. Whilst the current literature is limited to certain sub-populations of patients, a strong foundation has been set for future investigation of the technique within an ED setting. Future studies could potentially benefit from including larger cohorts of patients in order to increase the power of the findings, by including a comparison and contrast of the effectiveness of AP OX between presenting disease states, or even explore potential differences between differing protocols of RSI and the efficacy of AP OX.

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Received: November 24, 2016; **Accepted:** December 19, 2016; **Published:** December 22, 2016

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