

The Perils of Too Much Oxygen

It is a generally understood situation that a shortage of oxygen can compromise patient safety. Most people follow the link between low oxygen saturation in a patient and increased confusion, strokes, brain damage, cerebral palsy and even death. Not so widely known or easily understood is the concept of 'over dosage of oxygen' therapy.

There is concern among the clinical professions regarding the increased risk posed by excessive oxygen.

Oxygen Saturation Levels - a delicate balance

In Chronic Obstructive Pulmonary Disease (COPD) oxygen is one of the mainstays of management and as the name implies vital in 'long-term oxygen therapy' (LTOL). In these patients too much oxygen can cause significant illhealth and metabolic upset. The British Thoracic Society (BTS) guidelines(1) recommend not exceeding an oxygen saturation level of 93%. Whilst at the same time oxygen therapy should be increased if saturation falls below 90%.

Hyperoxia has been implicated in causing pulmonary toxicity leading to conditions from atelectasis to pro-inflammatory processes. Respiratory acidosis needing further intensive care in patients with COPD is known to be related to 'potential over-dosage' of oxygen(5).

Premature babies are at risk of developing Retinopathy of Prematurity (ROP) if they have high levels of oxygen. For this reason the level of oxygen administered and the ventilator settings are manipulated for the best outcomes. The clinical staff aim to maintain the baby's saturated oxygen level within set parameters.

Hyperoxia - risk to acutely ill patients

More recently the risks of hyperoxia on acutely ill patients with other conditions is beginning to be recognised(2). The patients with coronary disease are likely to be put at increased risk if oxygen is used injudiciously. Animal studies have shown reduction of blood flow to the



heart muscles especially in areas already suffering damage due to a shortage of oxygen (as may occur in a myocardial infarct - 'heart attack' and / or 'heart failure'). General body blood flow can also be altered with reduced output from the heart, raised blood pressure and increased resistance to blood flow in these patients reducing further the levels of oxygen getting to tissue throughout the body.

Thomson et al (2) comment on the study by Rawles(3) et al where those who had uncontrolled (and potentially excess) oxygen had an increase mortality and heart rhythm problems than those who received air. Additionally in Ronning et al's study (4) less patients were alive a year after a stroke if they were not hypoxic and been given oxygen - again suggesting increased adverse outcomes and side effects from too much oxygen being administered.

Harten et al(6) studied oxygen therapy following coronary artery bypass surgery and found that hyperoxia caused significant changes in the blood circulation. This was similar to that described above. The risks of hyperoxia increasing the damage caused by a previous episode of hypoxia in the neonate are discussed by Klinger et al(7).

Maintaining a delicate balance

In order to maintain the delicate balance between under and over treatment with oxygen it is increasing important to have accurate fast non-invasive bedside measurement techniques. Pulse oximetry is the obvious technology and is widely used.

However its level of accuracy is sometimes called into question, and at times does not live up to current expectations. Some place great confidence in The New Generation of

pulse oximetry, where improved software improves the ability of the system to detect weak and noisy signals. No matter how sophisticated the software the accuracy of the entire system is still dependant on the spectra emitted from the LEDs. Recent surveys of over 800 sensors from 30 UK hospitals have shown that over 30% of the sensors in use are either faulty or have errors capable of increasing the risk of an adverse incident.

If the optical properties of the sensor in use are not known, then every clinical decision that is based on that data is without foundation. The only device currently on the market capable of checking sensor accuracy is The Lightman www.electro.co.uk.

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