CONSENSUS STATEMENT

Guidelines on the Use of Oxygen in the Newborn

Perinatal Society of Malaysia, Malaysian Paediatric Association, Obstetrical & Gynaecological Society of Malaysia, Ophthalmological Society of Malaysia

The Use of Oxygen in the Newborn

Retinopathy of Prematurity (ROP) or retrolental fibroplasia (RLF) as it was earlier called was first described in 1942[1]. In the 1950's reports started to appear suggesting that oxygen toxicity was the possible cause[2] and by 1956 four randomised clinical trials on oxygen restriction had been published establishing the association between the unrestricted use of oxygen and ROP[3-6]. Restricted oxygen use led to a marked reduction in the prevalence of ROP but was accompanied by a large increase in neonatal morbidity and mortality. After the introduction of arterial oxygen measurement in the 1960's it was found that hypoxia could be prevented while the use of oxygen was restricted. Survival improved but ROP still occurred. With the advent of neonatal intensive care in the seventies and the increasing survival of smaller babies the incidence of ROP began to increase again.

In a population based study encompassing 3 British National Health Service authorities, Ng *et al* found an incidence of any grade of ROP of 49.1% in babies less than 1700g[7]. Reported incidences of Grade 3 and 4 ROP ranged from 4.2 to 9% of very low birth weight babies[7-9]. Immaturity is the most important risk factor but oxygen also plays a role. Apart from these, many other factors may be important in the pathogenesis of ROP. The American Academy of Pediatrics and American College of Obstetricians and Gynecologists Guidelines to Perinatal Care states that: "Apnoea, sepsis, nutritional deficiency and blood transfusions as well as prolonged oxygen therapy and ventilatory support (especially when accompanied by hypercapnia and hypoxia) have been associated with ROP"[10]. ROP was also reported in infants who had never received supplemental oxygen and in neonates with cyanotic congenital heart disease[11].

Intermittent arterial blood gas sampling is widely practised but has never been proven as a means of reducing ROP. The safe limits of P_aO_2 have never been established. The current recommended limits of P_aO_2 are 50 - 80 mm Hg[10]. The risk of ROP has been shown to be related to the length of time that the P_aO_2 is more than 80 mm Hg[12].

Transcutaneous oxygen monitoring and/or pulse oximetery allows for continuous monitoring of oxygen therapy. The AAP guidelines state that "the advantages of continuous oxygen monitoring are that it allows for timely assessment of oxygenation, allows for assessment of trends, and may reduce the need for and frequency of arterial blood gas samples. The disadvantages are that continuous oxygen monitoring tends to replace the use of arterial blood gas samples; adjustments in the fraction of inspired oxygen may be made too frequently, based on guidelines not substantiated by studies; and the transcutaneous O_2 saturation value may be confused with the transcutaneous P_aO_2 value. Thus far, there is no noninvasive method for determining the P_aO_2 that can completely replace intermittent arterial sampling. If used appropriately, transcutaneous oxygen monitoring may improve the care given to the ill neonate and infant. There should be an institutional policy for the documentation of oxygen therapy and monitoring. Current knowledge of the hazards and benefits of oxygen therapy is not complete." The Australian National Health and Medical Research Council have stated that pulse oximeters are probably safe if levels of 89 - 94% are maintained[13].

Current evidence suggests that ROP is linked to the duration of oxygen rather than the concentration, thus the use of 100% oxygen to resuscitate the newborn does not pose a problem. The American Academy of

Paediatrics and American Heart Association recommend that "... since the risk of hyperoxia over a short period is negligible compared with the risks of hypoxia, infants requiring resuscitation at birth should be given 100% oxygen"[14].

The multicentre trial for cryotherapy for retinopathy of prematurity gave clear evidence that cryotherapy can reduce the risk of progression of threshold disease[15,16]. It is therefore important that ROP be detected early and the affected neonates followed up until they are no longer at risk. Eye examination should begin with indirect ophthalmoscopy at 4 - 6 weeks of age for all infants < 1250 g and less than 32 weeks gestation. This should be repeated at 2 weekly intervals until the infant reaches term. If disease develops then these examinations should be repeated every week until the need for treatment is established. The need for surveillance in babies of higher gestations is not clear. Infants of 32 - 36 weeks who received oxygen for more than 6 hours should probably be followed up to term[17].

Recommendations

- Retinopathy of Prematurity (ROP) is currently not preventable in some neonates, even with optimal monitoring of oxygen therapy. Many factors other than hyperoxia may contribute to the pathogenesis of this condition.

- In an emergency when oxygen is needed, it should be used without restriction, and concern for ROP should not override the need to save a life. Transient elevations of PaO_2 do not cause ROP. However, supplemental O_2 should not be used without specific indications, such as respiratory distress, cyanosis or documented hypoxaemia.

- The use of supplemental oxygen beyond the emergency period should be monitored by means of regular arterial pO_2 measurements.

- Term infants requiring oxygen therapy for periods longer than a few hours and all preterm infants requiring oxygen should be managed in a facility where monitoring of oxygen therapy is available. When this is not possible, the amount of oxygen administered should be just enough to abolish cyanosis. It should be safe in the term neonate to administer oxygen for a few hours without monitoring arterial oxygen.

- Transcutaneous oxygen measurement and/or pulse oximetry allow for continuous monitoring of oxygen therapy. The recommended levels of SaO_2 are 89 to 95%. This should be supported by intermittent arterial blood gas analysis. A recommended range for most preterm neonates would be a PaO_2 of 50-80 mm Hg.

- In some neonates, efforts to keep the PaO_2 within this range may result in unacceptable episodes of hypoxia. In such a situation, it might be necessary to accept PaO_2 levels above this range. Documentation of such decisions is important.

- Recognising the benefits of early detection and treatment of ROP, eye examination at 4-6 weeks is recommended for
  - all babies less than 32 weeks gestation at birth or birth weight less than 1250gm.
  - preterms < 36 weeks who received oxygen depending on individual risk as assessed by the clinician.

  Eye examination should be repeated at 2 weekly intervals until the infant reaches term or is no longer at risk.*

**Every effort should be made to provide such a service for all these neonates, although it is recognised that access to Ophthalmological examination may be difficult in some parts of Malaysia.*

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