



Association of Women's Health, Obstetric, and Neonatal Nurses

AWHONN Response to ACOG's Practice Advisory on Oxygen Supplementation in the Setting of Category II or III Fetal Heart Rate Tracings

In January 2022, the American College of Obstetricians and Gynecologists (ACOG, 2022) issued a practice advisory about supplemental oxygen for patients in labor with an indeterminate (Category II) or abnormal (Category III) fetal heart rate tracing (FHR). Citing two publications, a systematic review of 16 randomized controlled trials (RCTs) (Raghuraman et al., 2021) and a report of a secondary data analysis from an RCT from a single institution (Raghuraman et al., 2020), the Committee on Clinical Practice Guidelines-Obstetrics at ACOG concluded that routine use of oxygen supplementation in individuals with normal oxygen saturation is not recommended for fetal intrauterine resuscitation.

Nurse scientists and clinicians at the Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN) reviewed the ACOG (2022) practice advisory and the cited publications. As part of the AWHONN Fetal Heart Monitoring program, available evidence is frequently evaluated and continually updated as needed. The most recent course materials and textbook have been published (Lyndon & Wisner, 2021). This is a very important clinical issue for nurses because nurses provide the vast majority of direct hands-on care to laboring women in the United States (National Academies of Sciences, Engineering, and Medicine, 2020) and are thus the clinicians most likely to be closely assessing the FHR tracing and determining the type and duration of common intrauterine resuscitation measures.

We present a summary of what is known on this topic and recommendations for consideration of administration of oxygen in selected women in labor with an indeterminate (Category II) or abnormal (Category III) FHR tracing.

Background

Intrauterine resuscitation measures are often used during labor when the FHR tracing is indeterminate (Category II) or abnormal (Category III). There are limited data on the frequency of intrauterine resuscitation measures based on current practice. A recent study, a secondary analysis of data of 11,108 patients, indicated 20.3% of patients required at least one intervention (maternal oxygen, intravenous [IV] fluid bolus, amnioinfusion, or a tocolytic) for intrauterine resuscitation (Reddy et al., 2021). These data were collected from 2010 to 2014 in a large, multicenter RCT of fetal ECG ST-segment analysis as an adjunct to conventional electronic fetal monitoring in laboring patients (Belfort et al., 2015). In an RCT where 277 patients were enrolled in 2016 and 2017 at a single institution, 41.2% of patients received intrauterine

resuscitation via maternal oxygen administration (Raghuraman et al., 2018) and in a before- and after-protocol design study at a single institution involving 844 women enrolled in 2016, approximately 50% of patients received intrauterine resuscitation via maternal oxygen administration (Ankumah et al., 2018).

The goal of intrauterine resuscitation is to promote normal maternal-fetal exchange by minimizing or correcting factors that may be problematic such as impaired uteroplacental blood flow, maternal hypotension, umbilical cord compression, and/or excessive uterine activity. Generally, maternal position change to right or left lateral is initiated first, followed by other measures such as an IV fluid bolus of approximately 500 mL of non-glucose containing solution (Simpson, 2021). Recurrent variable decelerations in first stage labor may be remedied by amnioinfusion if membranes are ruptured. Effects of recurrent variable decelerations in second stage labor can be reduced by modification of maternal pushing efforts, e.g., pushing every other or every third contraction or stopping pushing temporarily to allow the fetus to recover. Tachysystole secondary to oxytocin can be treated by maternal lateral positioning, an IV fluid bolus, and/or decreasing or discontinuing oxytocin based on the FHR patterns. If these measures are unsuccessful in decreasing uterine activity, subcutaneous terbutaline may be used (Simpson, 2021). Some types of FHR tracings during labor have characteristics that suggest the fetus may be at risk for hypoxemia, including minimal or absent variability in the context of recurrent late, variable, or prolonged decelerations. If these type of FHR patterns have not resolved with initial intrauterine resuscitation measures, an optional next step is maternal oxygen administration at 10 liters via nonrebreather face mask, which is estimated to result in 80% to 100% FiO₂ delivered to the mother (Simpson, 2021).

Evidence about Oxygen as an Intrauterine Resuscitation Measure during Labor

During the early years of use of electronic fetal monitoring, there was interest in determining the efficacy of maternal oxygen administration in improving fetal oxygen status. For example, in the 1960s, a number of researchers found positive results in increasing fetal oxygen status and resolving concerning FHR changes (Althabe et al., 1967; Gare et al., 1969; Khazin et al., 1969). In later years, when fetal pulse oximeter was available as a research tool, the effect of maternal oxygen administration was studied as well (Aldrich et al., 1994; Haydon et al, 2006; McNamara et al., 1993; Simpson & James, 2005) with consistent results indicating significant fetal uptake of oxygen when given to the mother.

An increase in fetal oxygen saturation occurs when the mother in labor is given 80% to 100% oxygen 10 liters via nonrebreather face mask (Haydon et al, 2006; McNamara et al., 1993; Simpson & James, 2005). This increase is relatively rapid, significant increases can be seen within 5 minutes (Simpson & James, 2005). Peak levels of fetal oxygen saturation are reached between 9 and 15 minutes after oxygen is initiated in these conditions (McNamara et al., 1993; Simpson & James, 2005). Fetuses with lower oxygen saturation (fetal oxygen saturation < 40%) take up greater amounts of oxygen than fetuses with higher oxygenation (fetal oxygen saturation ≥ 40%) suggesting fetuses in need may benefit most (Haydon et al, 2006; Simpson & James, 2005). The fetus responds to the changes in the placental oxygen gradient by accepting oxygen more rapidly than it gives it up (McNamara et al., 1993; Simpson & James, 2005). Positive effects on fetal oxygen saturation continue for at least 15 minutes after maternal oxygen

administration is discontinued (McNamara et al., 1993; Simpson & James, 2005). Placental equilibrium prevents fetal hyperoxia when the mother is given oxygen (Garite et al., 2015). Maternal oxygen administration does not appear to cause fetal oxidative stress (Ahuja et al., 2018; Khaw et al., 2009). Similar evidence of the transfer of oxygen to the fetus when given to the mother has been published in the anesthesia literature as summarized in the meta-analysis by Raghuraman et al. (2021). There are no data on long-term effects of supplemental oxygen administered to the mother and subsequently transferred to the fetus in utero.

Some researchers dismiss classic studies that were conducted years ago. If the methods are well described (e.g., type of device used to give the mother oxygen, how much was given and for how long, and the outcomes measured are clinically relevant), studies conducted longer than 10 years ago remain applicable to current practice. Some of the studies with implications for practice could not be conducted today because measurement techniques such as fetal pulse oximeter are no longer available, however the physiology of the mother and fetus has not changed.

Two recent studies have been published that show improvements in FHR patterns after intrauterine resuscitation (Moors et al. 2020; Reddy et al., 2021). In the Moors et al. 2020 RCT, 114 women in labor with an intermediary or abnormal FHR were enrolled and randomized to 100% oxygen at 10 L per face mask or conventional care. Improvement of FHR was seen more than four times more often in the intervention group compared to the control group (2.9 % vs 13.9%) while deterioration of FHR was seen four times less often in the intervention group than in the control group (8.3% vs 34.3%). The Reddy et al., (2021) study was a secondary analysis of data from an RCT involving 11,108 patients, 2,251 of whom received at least one intrauterine resuscitation measure, with oxygen the most common (75.4%). Reddy et al. (2021) reported at least two-thirds of category II FHR tracings improved to category I within 60 minutes of the intervention and those with absent accelerations and absent–minimal variability subgroup (n = 332) were more likely to convert to category I tracing within 60 minutes than those with FHR accelerations or moderate variability (n = 1919). In the Reddy et al. (2021) study, intrauterine resuscitation measures were followed by improvement in FHR tracings, however maternal oxygen administration was not the only measure used. These recent findings along with previous classic research suggest that the evidence about maternal oxygen administration in labor is not such that it should be abandoned as an option in selected women.

Evidence Cited in the ACOG Practice Advisory

The meta-analysis (Raghuraman et al., 2021) cited in the ACOG practice advisory includes 16 RCTs involving use of oxygen via nasal cannula or facemask versus room air. There was significant heterogeneity among the RCTs in how much oxygen was given, for how long, and why. For example, to deliver oxygen, a nasal cannula was used in five studies and a simple face mask was used in two studies. Some reported how much oxygen was given in FiO₂ while others used liters per minute, with a range of doses. Duration of oxygen administration varied. Of the 16 RCTs, only four were of women in labor (Moors et al., 2020; Qian et al. 2017; Raghuraman et al., 2018; Thorp et al., 1993). The other 12 RCTs involved women receiving oxygen prior to and/or during cesarean birth. Of the 4 RCTs of laboring women, only two

included therapeutic rather than prophylactic use of oxygen (indicated for a concerning FHR pattern) and at 10 liters per nonrebreather face mask (Moors et al., 2020; Raghuraman et al., 2018). These two studies produced conflicting results, with Moors et al. (2020) suggesting benefit and Raghuraman et al. (2018) showing no differences between groups, possibly because they were measuring different outcomes. In the Moors et al. (2020) study, a change (improvement) in FHR was the main outcome, while in the Raghuraman et al. (2018) study, the main outcome was umbilical artery lactate, a marker of metabolic acidosis and neonatal morbidity. Both had relatively small samples; Moors et al. (2020) n = 117 and Raghuraman et al. (2018) n = 114. Conclusions cannot be drawn from the meta-analysis (Raghuraman et al., 2021) to warrant a change in practice because there were only two studies of women in labor with therapeutic use of maternal oxygen administration for FHR characteristics considered concerning and at 10 L/nonrebreather face mask, heterogeneous methods, dosages, and duration of oxygen administration, and conflicting results.

Recommendations

- Oxygen should not be the first line intervention for intrauterine resuscitation, rather used if other measures are not successful and then discontinued when the concerning FHR characteristics have resolved (Simpson, 2008).
- Based on the available evidence, maternal oxygen therapy as an intrauterine resuscitation technique for 15 to 30 minutes appears to be reasonable, in selected cases such as a FHR tracing with minimal or absent variability in the context of recurrent late, variable, or prolonged decelerations if other intrauterine resuscitations measures have not been successful. Discontinuation of oxygen is based on the fetal response as noted by the FHR pattern or changes in the plan of care such as expeditious birth (O'Brien-Abel & Simpson, 2021).
- If the FHR tracing has moderate variability, fetal hypoxemia has generally been ruled out, so maternal oxygen administration is not indicated (Simpson, 2021).
- If there is concern for fetal wellbeing, simultaneous administration of oxygen and oxytocin does not make sense in the context of minimizing stress to the fetus (Simpson, 2020).

Summary

It is not prudent to abandon the option for use of maternal oxygen administration for selected patients in labor as an intrauterine resuscitation measure given the state of the evidence. Clearly this issue needs more study via randomized controlled trials in real world conditions during labor, using 10 liters of oxygen via non-rebreather face mask in the context of an indeterminate (Category II) or abnormal (Category III) FHR tracing. In the interim, as per long-standing AWHONN recommendations, reserve oxygen as an intrauterine resuscitation measure when other measures have not improved the FHR pattern and the characteristics of the FHR suggest risk of fetal hypoxemia, such as minimal or absent variability in the context of recurrent late, variable, or prolonged decelerations.

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