Low oxygen concentrations for embryo culture in assisted reproductive technologies

Background
During IVF and ICSI procedures, human preimplantation embryos are cultured in the laboratory. While some laboratories culture in an atmospheric oxygen concentration (20%), others use a lower concentration (5%) as this resembles more closely the oxygen concentration observed in the oviduct and the uterus. Animal studies have shown that atmospheric oxygen concentrations could have a negative impact on embryo quality via reactive oxygen species causing oxidative stress. In humans, it is currently unknown which oxygen concentration provides the best success rates of IVF/ICSI procedures resulting in the highest birth rate of healthy newborns. This is a summary of a meta-analysis recently published in the Cochrane Library (Bontekoe et al., 2012) evaluating whether embryo culture at low oxygen concentrations improves the treatment outcome when compared with embryo culture at atmospheric oxygen concentrations.

Methods
The Menstrual Disorders and Subfertility Group Trials Register, Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE and PsycINFO electronic databases and conference abstracts were searched (up to November 2011) for randomized controlled trials on the effect of low oxygen concentrations on human embryo culture. Only well designed and conducted randomized controlled trials comparing embryo culture at low oxygen concentrations (5%) with embryo culture at atmospheric oxygen concentrations (20%) were included in this systematic review and meta-analysis.

Data extraction and statistical analysis were performed in accordance with the guidelines of the Cochrane Collaboration by two review authors independently. The primary outcome was live birth. Secondary outcomes were clinical pregnancy, ongoing pregnancy, miscarriages, multiple pregnancies and congenital abnormalities. Results were presented as relative risks (RRs) with 95% confidence intervals (CIs).

Results

Trials and quality
Seven studies with a total of 2422 participants were included in the systematic review. Meta-analysis on the live birth rate could be performed with the data of three studies, with a total of 1291 participants. One of these studies had an unclear risk of bias. Two studies had a low risk of bias, although one of these did not report a proper method of allocation concealment.

Live birth rate
Evidence of a beneficial effect of culturing embryos in low oxygen concentration was found on the live birth rate [n = 1291; risk ratio (RR): 1.24; 95% CI: 1.07–1.44; P = 0.005; I² = 0%]; this would mean that live birth rates could improve from 31% using atmospheric oxygen concentration to somewhere between 32 and 43% by using a low oxygen concentration (see Figure).

Secondary outcomes
The results were very similar for ongoing [n = 1291; RR: 1.24; 95% CI: 1.07–1.44; P = 0.005; I² = 0%] and clinical pregnancy rates [n = 1382; RR: 1.19; 95% CI: 1.05–1.35; P = 0.008; I² = 0%]. There was no evidence that culturing embryos under low oxygen concentrations resulted in higher numbers of adverse events such as multiple pregnancies, miscarriages or congenital abnormalities.

Conclusions
The results of this systematic review and meta-analysis suggest that culturing embryos under low oxygen concentrations improves the success rates of IVF/ICSI, resulting in an increase in the live birth rate.

Reference

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