Study: SARS-CoV-2 infection has no clear negative effects on human oocyte and early embryo development

April 6 2023

Table 1 Baseline characteristics and embryo outcomes in COVID-19 and non-COVID-19 group[a)]

Characteristics	COVID-19 versus non-COVID-19			Subgroup analysis				
	COVID-19 (n=206)	Non-COVID-19 (n=700)	P value	≤7 days (n=93)	7–14 days (n=38)	>14 days (n=52)	Non-COVID-19 (n=700)	P value
Female age (year)	33.0 (30.75–36.0)	33.0 (30.0–36.0)	0.820	34.0 (31.0–36.0)	32.0 (30.0–34.3)	33.0 (31.0–36.0)	33.0 (30.0–36.0)	0.465
BMI, (kg m^{-2})	22.5 (20.6–25.1)	21.8 (20.0–24.2)	**0.019***	22.3 (20.4–24.8)	23.0 (21.0–25.9)	22.2 (21.1–25.0)	21.8 (20.0–24.2)	0.105
AMH, (ng mL^{-1})	2.5 (1.4–4.3)	2.8 (1.6–4.6)	0.336	2.5 (1.4–4.5)	3.0 (1.8–4.4)	2.5 (1.2–4.8)	2.8 (1.6–4.6)	0.886
Causes of infertility, n (%)			0.381					0.648
Tubal factors	100 (49.5%)	333 (48.8%)		44 (49.4%)	22 (57.9%)	26 (50.0%)	333 (48.8%)	
Male factor	29 (14.4%)	125 (18.3%)		12 (13.5%)	6 (15.8%)	6 (11.5%)	125 (18.3%)	
Others	73 (36.1%)	224 (32.8%)		33 (37.1%)	10 (26.3%)	20 (38.5%)	224 (32.8%)	
Female vaccination status								
Vaccination rate, n (%)	152 (73.8%)	423 (60.4%)	**<0.001***	69 (74.2%) [a]	24 (63.2%)[ab]	43 (82.7%) [ab]	423 (60.4%)[b]	**0.001***
TI, (d)	380.0 (314.0–495.4)	400.5 (297.0–509.3)	0.902	384.0 (322.0–489.0)	381.0 (311.5–497.8)	416.0 (303.0–524.0)	400.5 (297.0–509.3)	0.881
Male vaccination status								
Vaccination rate, n (%)	168 (81.6%)	479 (68.4%)	**<0.001***	70 (75.3%) [a]	34 (89.5%)[ab]	46 (88.5%) [b]	479 (68.4%) [b]	**0.001***
TI, (d)	378.0 (309.0–502.0)	410.0 (319.0–523.0)	0.230	382.5 (321.0–502.0)	378.0 (319.0–499.0)	358.5 (293.0–522.3)	410.0 (319.0–523.0)	0.542
Ovarian stimulation protocols, n (%)			**0.017***					**0.020***
Agonist protocol	93 (45.6%)	233 (34.7%)		39 (42.9%)	24 (63.2%)	21 (40.4%)	233 (34.7%)	
Antagonist protocol	85 (41.7%)	326 (48.5%)		37 (40.7%)	12 (31.6%)	23 (44.2%)	326 (48.5%)	
Others	26 (12.7%)	113 (16.8%)		15 (16.5%)	2 (5.3%)	8 (15.4%)	113 (16.8%)	
Fertilization type, n (%)			0.696					0.306
IVF	78 (44.1%)	309 (45.7%)		32 (44.4%)	21 (56.8%)	19 (36.5%)	309 (45.7%)	

a) BMI, Body mass index; AMH, anti-Müllerian hormone; TI, time interval between last dose of vaccination and the day of female oocyte retrieval; ICSI, intracytoplasmic sperm injection; MII, metaphase II; D3, Day3 after fertilization. Oocyte utilization rate=(embryos transferred+embryos frozen)/oocyteretrieved. Values are presented as median (IQR) or n (%); *, P14 days group. Oocyte quality and early embryo development indicators were

followed-up and compared in each group to assess the effect of COVID-19.

Baseline characteristics were similar between COVID-19 and non-COVID-19 groups, with the exceptions of body mass index (BMI), vaccination status and ovarian stimulation protocols. There were no significant differences in oocyte-related outcomes and embryo development outcomes between COVID-19 group and non-COVID-19 group, except the number of bipronuclear (2PN) zygotes [6.0 (IQR 3.0–10.0) vs. 5.0 (IQR 2.0–8.0), P = 0.021].

Subgroup analysis showed ≤7 days group, >14 days group and non-COVID-19 group did not differ in oocyte and embryo laboratory outcomes with each other. However, for women who were infected 7-14 days before oocyte retrieval, more 2PN zygotes [8.5 (IQR 4.0-11.0) vs. 5.0 (IQR 2.0-8.0)] were obtained, along with a higher oocyte utilization rate [45.3% (IQR 34.6%-60.0%) vs. 35.0% (IQR 20.0%-53.8%)], than the non-COVID-19 group.

We further performed multivariable linear regression analysis by adjusting BMI, vaccination status and ovarian stimulation protocols. The adjusted results suggested that infection 7-14 days before oocyte retrieval was found to increase the number of oocytes retrieved, the number of 2PN zygotes, and the number of good-quality embryos. But infection within 7 days before oocyte retrieval diminished oocyte utilization rate.

The study also investigated the effect of COVID-19 on the female only and male only infected populations. The female only infected group had a higher number of 2PN compared to the non-COVID-19 group, with no significant differences in other indicators. In the male only infected group, there was no difference in outcomes compared to the non-COVID-19 group, but a reduction in progressive motility of sperm and good-quality embryos rate were identified in male only infected group

despite there was no statistical significance.

Overall, the study suggested that COVID-19 did not have a clear negative effect on oocyte quality or embryo development. However, the pros and cons should be fully weighed in women with acute infection. This study provided favorable evidence for the successful implementation of ART during epidemic. It is hoped that this will inform clinical work and strengthen the confidence of patients in receiving ART treatment during COVID-19 epidemic.

Owing to the limitation of this study having a short follow-up and small sample size, the effects of COVID-19 on pregnancy and live birth are not clear yet. Researchers will further trace long-term pregnancy outcomes as well as the health of off-spring in this prospective cohort study.

More information: Xiaolei Chen et al, The effect of SARS-CoV-2 infection on human embryo early development: a multicenter prospective cohort study, *Science China Life Sciences* (2023). DOI: 10.1007/s11427-023-2291-0

Provided by Science China Press