Original Article

Pregnancy Outcomes of *In Vitro* Fertilization with or without Ovarian Hyperstimulation Syndrome: A Retrospective Cohort Study in Chinese Patients

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Abstract

Background: The effect of ovarian hyperstimulation syndrome (OHSS) on pregnancy outcomes of *in vitro* fertilization (IVF) patients is still ambiguous. This study aimed to analyze pregnancy outcomes of IVF with or without OHSS in Chinese patients.

Methods: A retrospective cohort study was undertaken to compare pregnancy outcomes between 190 women with OHSS and 197 women without OHSS. We examined the rates of clinical pregnancy, multiple pregnancies, miscarriage, live birth, preterm delivery, preterm birth before 34 weeks' gestation, cesarean delivery, low birth weight (LBW), and small-for-gestational age (SGA) between the two groups. Odds ratios (*OR*s) and 95% confidence intervals (*CI*s) of measure of clinical pregnancy were also analyzed.

Results: The clinical pregnancy rate of OHSS patients was significantly higher than that of non-OHSS patients (91.8% vs. 43.5%, $P < 0.001$). After controlling for drug protocol and causes of infertility, the adjusted *OR*s of moderate OHSS and severe/critical OHSS for clinical pregnancy were 4.65 (95% *CI*, 1.86–11.61) and 5.83 (95% *CI*, 3.45–9.86), respectively. There were no significant differences in rates of multiple pregnancy (4.0% vs. 3.7%) and miscarriage (16.1% vs. 17.5%) between the two groups. With regard to ongoing clinical pregnancy, we also found no significant differences in the rates of live birth (82.1% vs. 78.8%), preterm delivery (20.9% vs. 17.5%), preterm birth before 34 weeks' gestation (8.6% vs. 7.9%), cesarean delivery (84.9% vs. 66.3%), LBW (30.2% vs. 23.5%), and SGA (21.9% vs. 17.6%) between the two groups.

Conclusion: OHSS, which occurs in the luteal phase or early pregnancy in IVF patients and represents abnormal transient hemodynamics, does not exert any obviously adverse effect on the subsequent pregnancy.

Key words: *In Vitro* Fertilization; Miscarriage; Ovarian Hyperstimulation Syndrome; Pregnancy Outcome; Pregnancy Rate

Introduction

Ovarian hyperstimulation syndrome (OHSS) is an iatrogenic complication of assisted reproductive technology (ART) with development of multiple follicles. OHSS is characterized by cystic enlargement of the ovaries and an acute fluid shift from the intravascular compartment to the third space, which may result in ascites, pleural and/or pericardial infusion, and even generalized edema. OHSS patients suffer from lower abdominal discomfort, nausea, and vomiting. In severe cases of OHSS, thromboembolic events, acute respiratory distress syndrome (ARDS), and renal failure have been reported.[1]

Clinical practitioners are unsure whether OHSS and subsequent treatments, such as incessant pleural or abdominal punctures, volume expansion, and diuretics, would have an adverse effect on pregnancy outcomes of OHSS patients. Previous research on this topic had a lack of an appropriate contemporaneous control group, and there were potential confounders in the research, thus making interpretation of such data unclear. In the current study, based on consistent age and count of mature II (M-II) oocytes,

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we compared pregnancy outcomes of patients with and without OHSS, and examined the possible effects of OHSS on pregnancy outcomes.

Methods

Study subjects

The *in vitro* fertilization (IVF) database was set up and maintained by research faculty members in our department. OHSS patients except for mild OHSS patients diagnosed and treated in our hospital from 2002 to 2012 were included, and basic information was recorded in the database. The research was approved by the College Institutional Review Board. Informed consent was not required because of the retrospective nature of this study.

The investigation was 1:1 and 1:2 retrospective cohort study. From 2002 to 2012, we identified 190 IVF patients with OHSS. In a total population of 5487 IVF fresh cycles, 197 contemporaneous non-OHSS cycles matched for age and count of M-II oocytes were selected as the unexposed group. The amount discrepancy of age and count of M-II oocytes between the two or three matching patients was no more than 2. The corresponding non-OHSS cycle occurred in the same or near month with the OHSS cycle.

Inclusion and exclusion criteria

OHSS can be classified into mild, moderate, severe, and critical ones. While in our study, we excluded the mild OHSS patients since they were treated outpatient. The severity of OHSS was defined according to the criteria proposed by Golan *et al*.[2] and Navot *et al*.[3] Moderate OHSS was characterized by abdominal distension and discomfort, nausea, vomiting or diarrhea, enlarged ovarian size (5–12 cm), and ultrasonic evidence of ascites. Severe OHSS was characterized by variable ovarian enlargement; massive ascites ± hydrothorax; hematocrit >45%; white blood cell count >15,000/ml; oliguria; creatinine 1.0–1.5 mg/dl; liver dysfunction; and anasarca. Critical OHSS was characterized by variable ovarian enlargement; tense ascites ± hydrothorax; hematocrit >55%; white blood cell count >25,000/ml; oliguria; creatinine ≥1.6 mg/dl; creatinine clearance <50 ml/min; renal failure; thromboembolic phenomena; and ARDS.

Treatments

OHSS patients were hospitalized. Intake and output volume, body weight, and abdominal circumference were recorded daily. Hematocrit, white blood cell count, and liver and kidney function indices were dynamically monitored. Changes in ovarian size and abdominal or pleural fluid were monitored by ultrasound when necessary. All of the patients were administered intravenous albumin or hydroxyethyl starch. Based on the status of disease, liver-protecting, anti-infection, and diuretic treatments, as well as drainage of abdominal and pleural fluid, were administered.

Outcome indicators

Pregnancy outcomes included clinical pregnancy, miscarriage, miscarriage of one twin, fetal intrauterine death, gestational age at birth, delivery mode, neonatal birth weight, and neonatal deformity. Clinical pregnancy met the standard of gestational sac under ultrasound diagnosis. Miscarriage included early- and late-term miscarriage. Early miscarriage occurred before 12 gestational weeks, and late-term miscarriage was between 13 and 28 gestational weeks. Premature delivery was defined as birth before 37 and after 28 completed weeks of pregnancy. Low birth weight (LBW) was defined as birth weight below 2500 g, and small-for-gestational age (SGA) was defined as a birth weight lower than the tenth percentile of the same gestational age of neonatal birth weight.

Statistical analysis

Data were expressed as mean ± standard deviation (SD), median (interquartile range), or *n* (%). Continuous variables were compared using Student's *t*-test or Mann–Whitney *U*-test. Categorical variables were assessed using the Chi-square test. Logistic regression analysis was used to evaluate the association between OHSS and clinical pregnancy. Odds ratios (*OR*s) and 95% confidence intervals (*CI*s) were calculated after adjustment for controlled ovarian hyperstimulation (COH) protocol, gonadotropin (Gn) dosage, human chorionic gonadotropin (HCG) dose protocol on HCG day, luteal supporting protocol, polycystic ovary syndrome (PCOS), and anovulation. All statistical analyses were performed using SPSS 17.0 (SPSS Inc., USA). A $P < 0.05$ was considered statistically significant.

Results

We identified 39 moderate (20.5%), 141 severe (74.2%), and 10 critical (5.3%) OHSS patients. The incidence of OHSS among 5487 fresh IVF cycles was 3.46%, and the rates of serious adverse events and thromboembolism in OHSS patients were 2.63% and 1.58%, respectively. The median duration of hospitalization was 11 days (2–73 days) and the mean number of abdominal and plural punctures was 3 (range: 0–18).

Comparison of IVF data between IVF patients with or without OHSS is shown in Table 1. The mean dosage of Gn used for ovulation induction for OHSS patients was lower than that of non-OHSS ($P = 0.007$). The clinical characteristics, including age, body mass index, diagnosis of infertility, and duration of infertility, were not significantly different between the two groups [Table 1]. Additionally, no significant difference was found in basal follicle-stimulating hormone or serum estradiol (E_2) levels on HCG day between the groups.

Table 2 shows the outcomes of pregnancy. Seven patients with OHSS canceled embryo transfer (ET) because of early-onset severe OHSS, and 13 patients without OHSS canceled ET for a high risk of OHSS. Among the 183 OHSS patients who did undergo ET, 168 patients achieved clinical pregnancy with a clinical pregnancy rate of 91.8%, which was significantly higher than that in the control group (43.5%, $P < 0.001$). The rates of multiple pregnancy and miscarriage

Table 1: Comparison of IVF data between OHSS and non-OHSS groups

Items	OHSS group (n = 190)	Non-OHSS group (n = 197)	P
Age (years)	32.0 ± 4.0	32.0 ± 3.8	0.871
BMI (kg/m^2)	21.9 ± 3.0	22.1 ± 2.8	0.533
Nulligravida, n (%)	107 (56.3)	112 (56.9)	0.915
Duration of infertility (years), median (IQR)	4 (2–6)	4 (2–6)	0.868
Indication for IVF, n (%)			
Anovulation	50 (26.3)	42 (21.3)	0.248
PCOS	21 (11.1)	27 (13.7)	0.428
Tubal	78 (41.1)	84 (42.6)	0.752
Male	84 (44.2)	86 (43.7)	0.912
Endometriosis	34 (17.9)	33 (16.8)	0.766
Unexplained	3 (1.6)	3 (1.5)	1.000
Multiple	62 (32.6)	54 (27.4)	0.262
Basal FSH (μU/ml)	6.49 ± 1.89	6.81 ± 2.18	0.125
COH protocol, n (%)			0.206
Long protocol	109 (57.4)	103 (52.3)	
Short protocol	21 (11.1)	37 (18.8)	
Ultra-long protocol	22 (11.6)	20 (10.2)	
Step-down long protocol	38 (20.0)	37 (18.8)	
Gn dosage (U)	2255 ± 773	2477 ± 830	0.007*
Serum E_2 on HCG day (pg/ml)	3823 ± 2358	3513 ± 1560	0.162
HCG dose on HCG day, n (%)			0.272
HCG 10,000 IU	118 (62.1)	134 (68.0)	
HCG 5000 IU	14 (7.4)	8 (4.1)	
rHCG	58 (30.5)	55 (27.9)	
Count of M-II oocytes, median (IQR)	13 (10–16)	13 (10–16)	0.743
Embryos retrieved, median (IQR)	12 (9–15)	12 (9–15)	0.891
Embryos transferred, median (IQR)	2 (2–3)	2 (2–3)	0.089
Luteal supporting protocol, n (%)			0.111
Progesterone	10 (5.5)	3 (1.6)	
Progesterone with HCG	166 (90.7)	176 (95.7)	
Progesterone with rHCG	7 (3.8)	5 (2.7)	
HCG dose for luteal-sup (U)	2343 ± 1740	3443 ± 2201	<0.001

Data were showed as mean ± SD, median (IQR), or n (%). OHSS: Ovarian hyperstimulation syndrome; BMI: Body mass index; IVF: *In vitro* fertilization; PCOS: Polycystic ovary syndrome; FSH: Follicle-stimulating hormone; COH: Controlled ovarian hyperstimulation; Gn: Gonadotropin; HCG: Human chorionic gonadotropin; rHCG: Recombinant human chorionic gonadotropin; M-II: Mature-II; IQR: Interquartile range; E_2: Estradiol; SD: Standard deviation.

were not significantly different between the two groups, and all the triplets and quadruplets were surgically reduced to twins during 9–12 weeks of gestational age.

The delivery outcomes of 138 OHSS live births (84 singletons, 54 twins) were compared with those of the control group, which were 63 live births (41 singletons, 22 twins). We found no significant differences in the rates of live birth (82.1% vs. 78.8%), preterm delivery (20.9% vs. 17.5%), preterm birth before 34 weeks' gestation (8.6% vs. 7.9%), singleton LBW (9.5% vs. 4.9%), and singleton SGA (7.1% vs. 7.3%) between the two groups. The pregnancy outcomes of five critical OHSS patients are shown in Table 3.

Table 2: Comparison of pregnancy outcomes between OHSS and non-OHSS group

Items	OHSS group (n = 190)	Non-OHSS group (n = 197)	P
Transferring cycles	183 (96.3)	184 (93.4)	0.195
Clinical pregnancy	168 (91.8)	80 (43.5)	<0.001
Singletons	89 (53.0)	46 (57.5)	0.800
Twins	72 (43.0)	31 (38.8)	
Triplets	7 (4.0)	2 (2.5)	1.000
Quadruplets	0 (0)	1 (1.2)	
Miscarriage	25 (14.9)	13 (16.3)	0.777
Miscarriage of one twin	17 (10.1)	8 (10.0)	0.977
Intrauterine fetal death	2 (1.2)	1 (1.3)	1.000
Live-birth	138 (82.1)	63 (78.8)	0.524
Singletons	84 (60.9)	41 (65.1)	0.568
Twins	54 (39.1)	22 (34.9)	
Preterm delivery	29 (20.9)	11 (17.5)	0.574
Birth before 34 weeks	12 (8.6)	5 (7.9)	0.869
Delivery week	37.7 ± 2.3	37.7 ± 2.0	0.951
Mode of delivery			
Cesarean section	118 (84.9)	53 (84.1)	0.889
Vaginal delivery	21 (15.1)	10 (15.9)	
Neonatal births	192	85	
Neonatal deaths	2 (1.0)	0 (0)	1.000
Birth weight (g)	2813 ± 620	2880 ± 607	0.401
LBW	58 (30.2)	20 (23.5)	0.254
SGA	42 (21.9)	15 (17.6)	0.422
Singleton LBW	8 (9.5)	2 (4.9)	0.584
Singleton SGA	6 (7.1)	3 (7.3)	1.000
Neonatal deformity	0 (0)	1 (1.2)	0.307

Data were showed as mean ± SD or n (%). LBW: Low birth weight; SGA: Small-for-gestational age; OHSS: Ovarian hyperstimulation syndrome; SD: Standard deviation.

Thereafter, we compared IVF data of moderate OHSS, severe/critical OHSS with that of non-OHSS patients, respectively [Table 4]. The proportion of different COH protocol was statistically different between severe/critical OHSS and non-OHSS patients (P = 0.039). The proportion of short protocol was comparatively higher in non-OHSS than severe/critical OHSS patients. After controlling for COH protocol, Gn dosage, HCG dose on HCG day, luteal supporting protocol, PCOS, and anovulation, OHSS was associated with increased probability of clinical pregnancy. The adjusted *OR*s of moderate OHSS and severe/critical OHSS for clinical pregnancy were 4.65 (95% *CI*, 1.86–11.61) and 5.83 (95% *CI*, 3.45–9.86), respectively.

Discussion

ART has been carried out for more than 30 years. Clinical practitioners have always been committed to improving ovarian stimulation protocols to keep the incidence of OHSS no more than 5%. However, critical OHSS occasionally occurs, including acute renal failure, thrombosis, stroke, pulmonary edema, myocardial

infarction, ARDS, and even maternal death.[4-11] Considering OHSS-associated complications, clinical practitioners and patients need to determine whether to terminate pregnancy because this would substantially alleviate the condition of OHSS patients. While most patients choose to continue pregnancy because this disease is self-limited, they are also wondering whether OHSS would bring adverse impact to pregnancy.

Table 3: Pregnancy and maternal outcome of OHSS patients with major complications

Patients number	Adverse events	Pregnancy outcomes	Maternal outcomes
1	Brachial arterial thrombosis	Live birth	Alleviated after therapy
2	Calf muscular venous thrombosis	Live birth	Alleviated after therapy
3	Cerebral infarction	Termination	Mixed aphasia
4	ARDS	Live birth	Alleviated after therapy
5	Type-I respiratory failure	Failure	Alleviated after therapy

ARDS: Acute respiratory distress syndrome; OHSS: Ovarian hyperstimulation syndrome.

A previous study has demonstrated that OHSS is more likely to occur at a younger age and in treatment cycles with the highest ovarian response to stimulation.[12] Additionally, infertility is an independent factor that appears to be involved with a poor obstetric outcome.[13] Furthermore, age is the primary determinant of live births. The oocyte yield, independent of age, shows a linear relationship with live births with up to 15 oocytes in IVF cycles.[14] Therefore, to exclude potential bias, we matched age and count of M-II oocytes. Body mass index, causes of infertility, length of infertility, and basal ovarian function in the two groups were assessed. We observed that the dosage of Gn for ovarian

Table 4: Comparison of IVF data among moderate, severe/critical OHSS and non-OHSS patients

Items	Non-OHSS group (n = 197)	Moderate OHSS (n = 39)	Severe/critical OHSS (n = 151)	P_1	P_2
Age (years)	32.0 ± 3.8	32.0 ± 4.4	32.0 ± 4.0	0.929	0.875
BMI (kg/m^2)	22.1 ± 2.8	22.0 ± 3.3	21.9 ± 2.9	0.643	0.490
Nulligravida, *n* (%)	112 (56.9)	21 (53.8)	86 (57.0)	0.729	0.985
Duration of infertility (years), median (IQR)	4 (2–6)	5 (3–8)	4 (2–6)	0.227	0.757
Indication for IVF, *n* (%)					
Anovulation	42 (21.3)	8 (20.5)	42 (27.8)	0.910	0.161
PCOS	27 (13.7)	8 (20.5)	13 (8.6)	0.274	0.140
Tubal	84 (42.6)	14 (35.9)	64 (42.4)	0.435	0.962
Male	86 (43.7)	22 (56.4)	62 (41.1)	0.144	0.627
Endometriosis	33 (16.8)	5 (12.8)	29 (19.2)	0.542	0.553
Unexplained	3 (1.5)	1 (2.6)	2 (1.3)	0.517	1.000
Multiple	54 (27.4)	13 (33.3)	49 (32.5)	0.454	0.307
Basal FSH (μU/ml)	6.81 ± 2.18	6.32 ± 1.33	6.53 ± 2.01	0.171	0.256
COH protocol, *n* (%)				0.866	0.039
Long protocol	103 (52.3)	21 (53.8)	88 (58.3)		
Short protocol	37 (18.8)	9 (23.1)	12 (7.9)		
Ultra-long protocol	20 (10.2)	3 (7.7)	19 (12.6)		
Step-down long protocol	37 (18.8)	6 (15.4)	32 (21.2)		
Gn dosage (U)	2477 ± 830	2262 ± 834	2254 ± 760	0.120	0.007
Serum E_2 on HCG day (pg/ml)	3513 ± 1560	4414 ± 3998	3670 ± 1686	0.084	0.356
HCG dose on HCG day, *n* (%)				0.008	0.816
HCG 10,000 U	134 (68.0)	19 (48.7)	99 (65.6)		
HCG 5000 U	8 (4.1)	6 (15.4)	8 (5.3)		
rHCG	55 (27.9)	14 (35.9)	44 (29.1)		
Count of M-II oocytes, median (IQR)	13 (10–16)	13 (10–17)	13 (10–16)	0.469	0.956
Embryos retrieved, median (IQR)	12 (9–15)	11 (10–17)	12 (9–15)	0.703	0.804
Embryos transferred, median (IQR)	2 (2–3)	2 (2–3)	2 (2–3)	0.642	0.065
Luteal supporting protocol, *n* (%)				0.054	0.210
Progesterone	3 (1.6)	3 (9.1)	7 (4.7)		
Progesterone with HCG	176 (95.7)	29 (87.9)	137 (91.3)		
Progesterone with rHCG	5 (2.7)	1 (3.0)	6 (4.0)		
HCG dose for luteal-sup (U)	3443 ± 2201	2517 ± 1271	2306 ± 1825	0.071	<0.001

Data were showed as mean ± SD, median (IQR), or *n* (%). P_1 represents moderate OHSS compared with non-OHSS patients and P_2 represents severe/critical OHSS compared with non-OHSS patients. OHSS: Ovarian hyperstimulation syndrome; BMI: Body mass index; IVF: *In vitro* fertilization; PCOS: Polycystic ovary syndrome; FSH: Follicle-stimulating hormone; COH: Controlled ovarian hyperstimulation; Gn: Gonadotropin; HCG: Human chorionic gonadotropin; rHCG: Recombinant human chorionic gonadotropin; M-II: Mature-II; IQR: Interquartile range; E_2: Estradiol; SD: Standard deviation.

stimulation and HCG for luteal support was significantly lower in OHSS patients than in non-OHSS patients, which suggested that OHSS patients were more sensitive to stimulatory drugs.

Multiple studies have reported that the clinical pregnancy rate in OHSS patients is significantly higher than that in general IVF patients or non-OHSS patients.[15-17] This finding is similar to our results. To a great extent, pregnancy triggers and aggravates OHSS, and this is called late-term onset OHSS. Late OHSS is triggered by endogenous HCG release in the event of pregnancy, generally occurring after 9–10 days following HCG injection. Early OHSS is caused by administration of exogenous HCG, which appears to be associated with an excessive ovarian response to Gn stimulation, generally occurring before the 9th and 10th day after HCG injection.[18] Because we performed a retrospective study, it is difficult to define the onset model according to patients' subjective recall.

In terms of pregnancy outcome, the rates of miscarriage and perinatal complications including preterm birth, SGA, pregnancy-induced hypertension and/or stillbirth were significantly higher in OHSS group than non-OHSS group, as reported in literature. We analyzed that it was probably the relatively higher rate of multiple pregnancy that induced massive perinatal complications [Table 5]. Pregnancy and multiple pregnancies dramatically worsen the situation of OHSS patients.[12] Similar miscarriage rates between groups were observed after excluding this confounder in our study and Courbiere's series.[19]

Some authors have postulated that systemic vascular dysfunction and microthromboembolic events might affect trophoblastic invasion, leading to placental insufficiency.[19] Thromboembolic events occurred in four of the 40 OHSS pregnant patients in Courbiere's study, characterized by increased thromboembolic events up to 10%, with a comparably higher rate of preterm than non-OHSS pregnant patients.[19] We may hypothesize that this seemingly higher rate of preterm may be due to thrombosis. Not all of the thrombosis in IVF patients was correlated with OHSS, and IVF pregnant patients complicated by OHSS had an increased risk of arterial thrombosis.[1] Therefore, OHSS and pregnancy could be viewed as precipitating factors for thrombosis in IVF.[20]

Supraphysiological ovarian stimulation results in E_2 levels greater than those in natural conception (NC) cycles and causes E_2 levels in the early stage to be similar to those in the late stage of the first trimester of NC.[12] Previous studies showed that the high maternal E_2 environment in the first trimester was correlated with increased risks of LBW and SGA.[21] Additionally, the birth rates of singleton LBW and singleton SGA of fresh ET were significantly higher than those of frozen ET and NC (6.3%, 4.4%, and 3.6%, and 6.9%, 5.0%, and 4.8%, respectively).[21] Large-scale studies in China on the epidemiology of SGA and LBW are still lacking. Some hospital-based studies and regional investigations have described that the rate of preterm birth ranges from 3.1% to 5.8%, LBW is 1.6%, and SGA is 2.9%.[22,23] In the aggregate series, the rate of singleton preterm birth was 8.8%, singleton LBW was 8.0%, and singleton SGA was 7.2%. Generally, rates of preterm birth and LBW or SGA were higher in IVF cycles than in NC.

In conclusion, OHSS, which occurs in the luteal phase or early pregnancy of IVF patients and represents transient abnormal hemodynamics, was not found to exert any obviously adverse effect on the subsequent pregnancy. However, whether OHSS would exert adverse effect on the offsprings of IVF mothers in the long-term, required further studies.

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Conflicts of interest

There are no conflicts of interest.

Table 5: Comparison of pregnancy outcome between OHSS and non-OHSS group, literature review

Studies	Thrombosis rate	Multiple pregnancy rate	Clinical pregnancy rate	Miscarriage rate	Perinatal complication
Abramov *et al.* (1998)	2.5%	24% versus 3–5%	73.2% versus 14.4%	29.5% versus 18.0–22.0%	Preterm (44% vs. 24–29%); LBW (62.1% vs. 24–36%); PIH (13.2% vs. 6.0%)
Mathur and Jenkins (2000)	–	36.1% versus 27.4%	–	12.1% versus 16.8%	–
Luke *et al.* (2010)	–	58–86%$^{\uparrow}$	98–168%$^{\uparrow\uparrow}$	–	Preterm birth; LBW Stillbirth: 26–31%$^{\uparrow}$
Courbiere *et al.* (2011)	10%	2.5% versus 2.5%	–	17.5% versus 16%	Preterm (36.0% vs. 10.7%); PIH (21.2% vs. 9.2%)
Current study	1.58%	4.0% versus 3.7%	91.8% versus 45.1%	14.9% versus 16.3%	No difference

–: Data not mentioned. $^{\uparrow}$: Compared with non-OHSS patients, the multiple pregnancy rate of OHSS patients increased 58%–86%; the rate of perinatal complication including preterm birth, LBW and stillbirth, of OHSS patients increased 26–31%. $^{\uparrow\uparrow}$: Compared with non-OHSS patients, the clinical pregnancy rate of OHSS patients increased 98%–168%. PIH: Pregnancy-induced hypertention; LBW: Low birth weight; OHSS: Ovarian hyperstimulation syndrome.

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